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MACHINERY:

VOL. 1. Nº 12. AUGUST: 1895.

A PRACTICAL JOURNAL FOR MACHINISTS AND ENGINEERS
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CONTENTS.

WORKSHOP ECONOMICS—THE MILLING MACHINE. CHAS. O. HEGGEM.

HEATING WITH EXHAUST STEAM. W. H. WAKEMAN.

AMONG THE SHOPS. FRED H. COLVIN.

COUNTERBALANCING. W. H. BOOTH.

NOTES FROM NOTOWN. ICHABOD PODUNK.

A TURRET TOOL. WM. O. WEBBER.

MORE ABOUT BORING CYLINDERS.

SLIDE-VALVE STUDY. ROBERT GRIMSHAW.

AN ELECTRIC TRAVELLING CRANE. A. BOLLINCKX.

ABOUT DRILLING HOLES. HERMAN RITTER.

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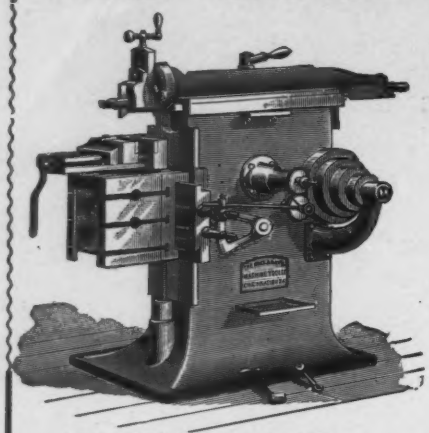

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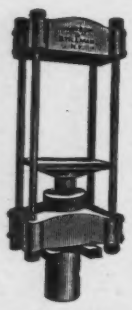

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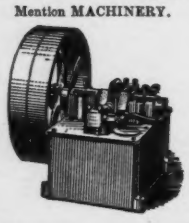

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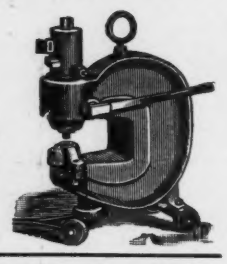

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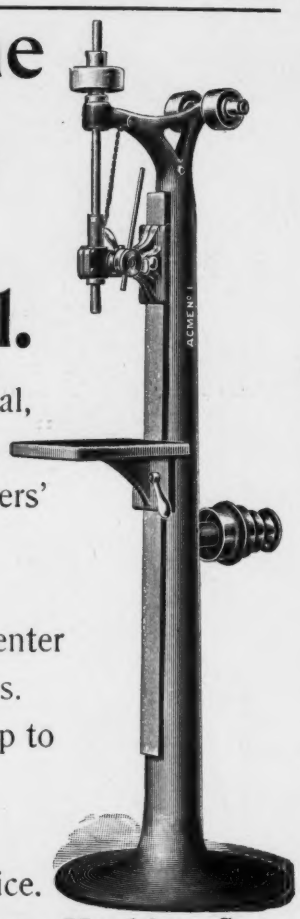

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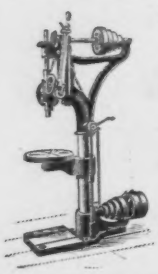

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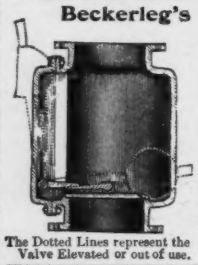

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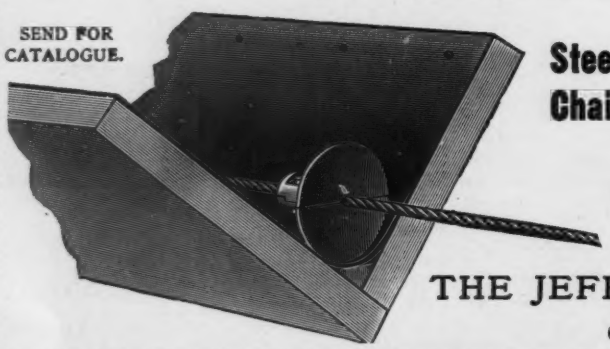

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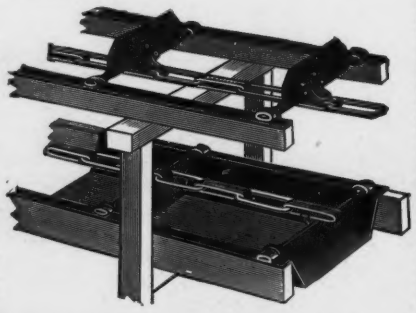

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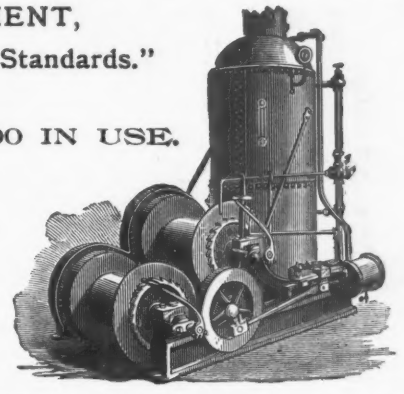

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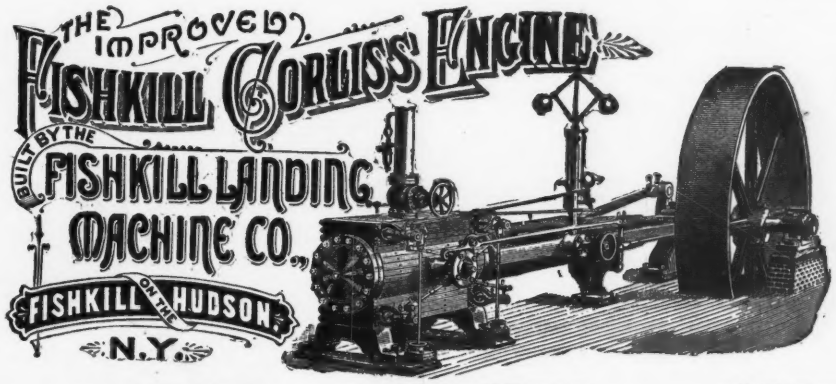

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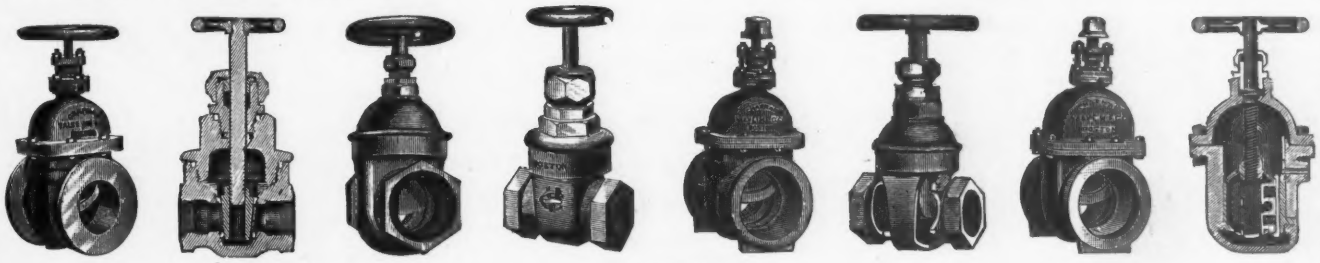

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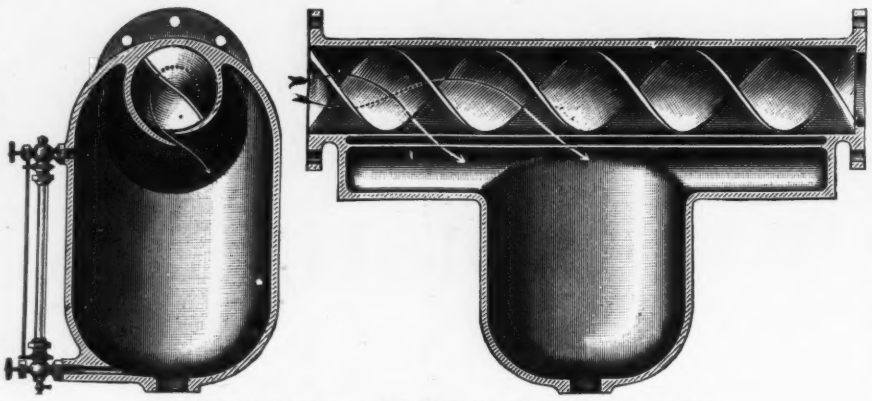

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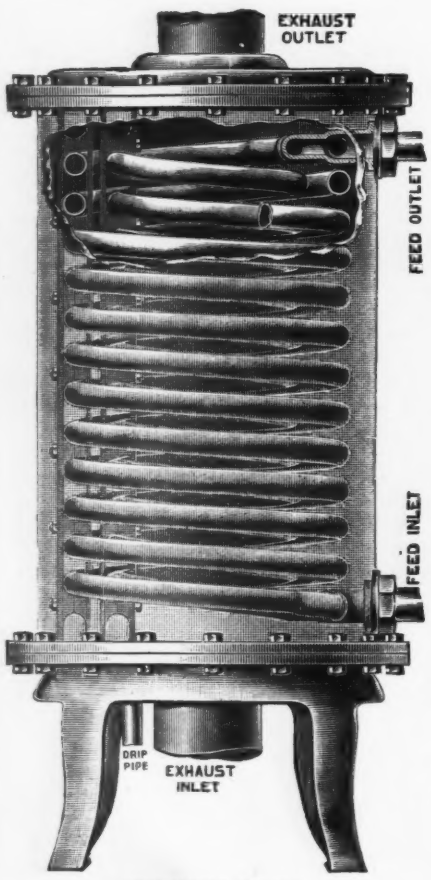

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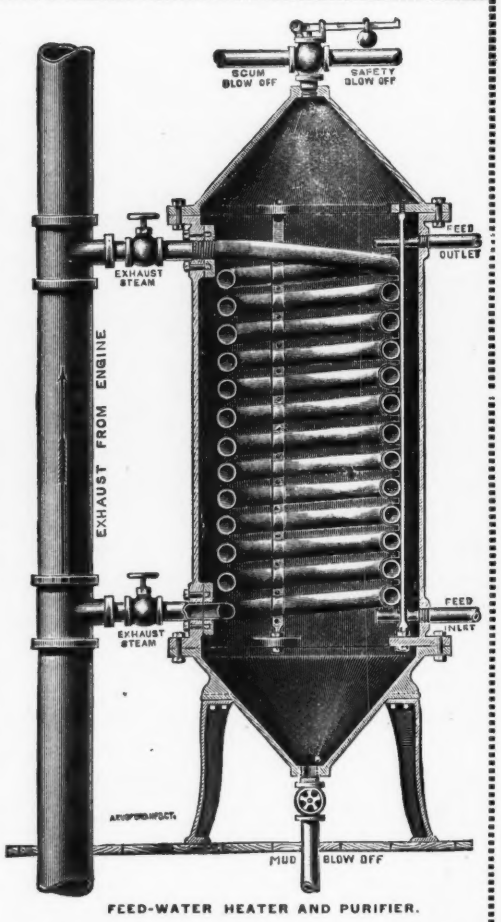

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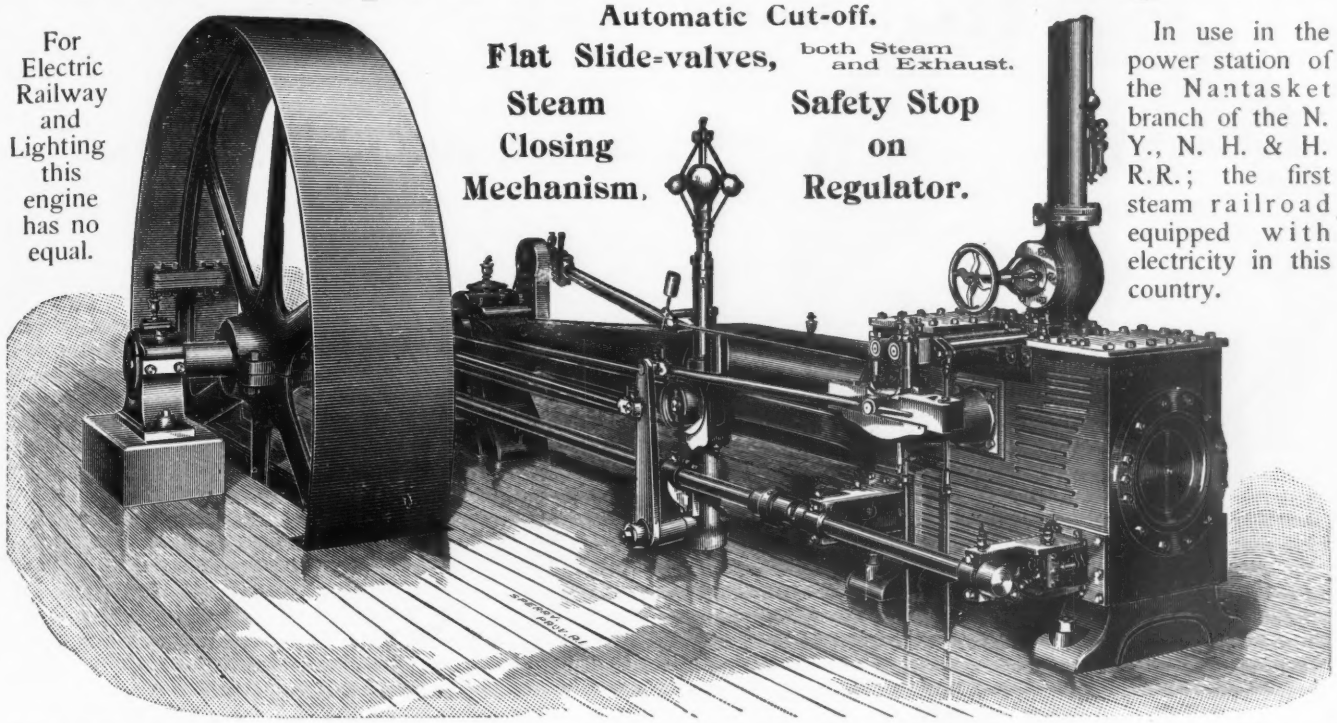

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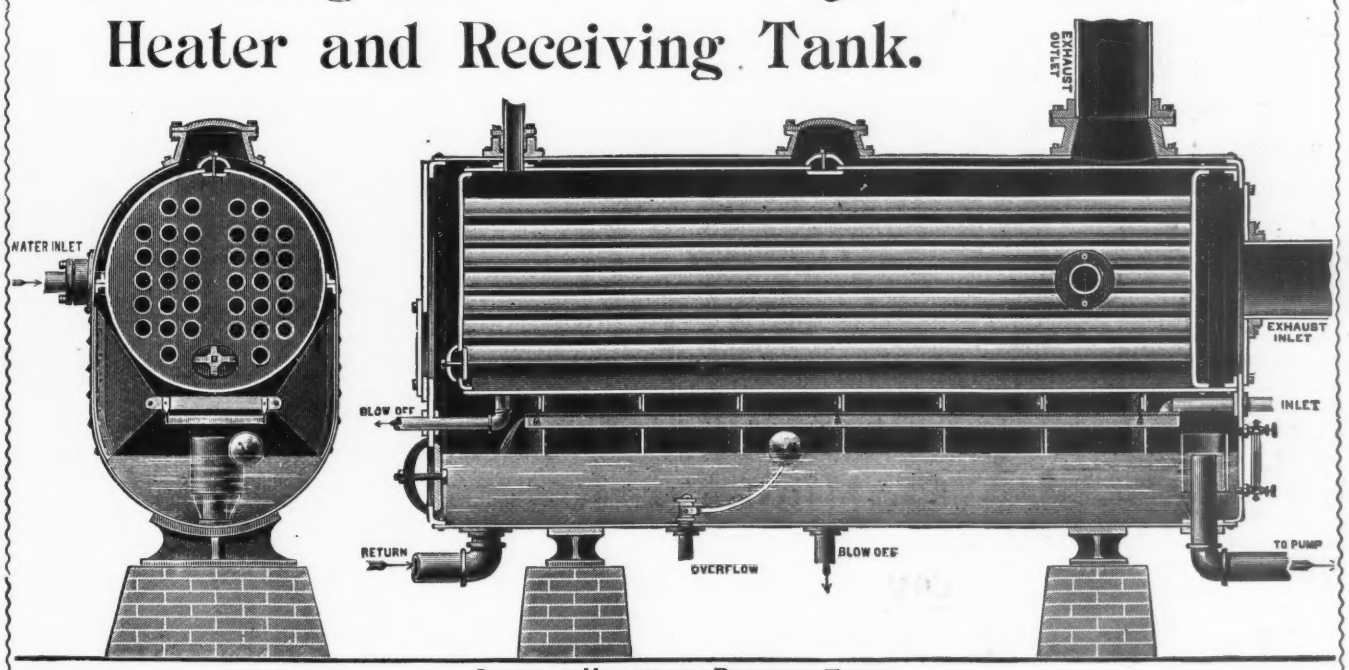

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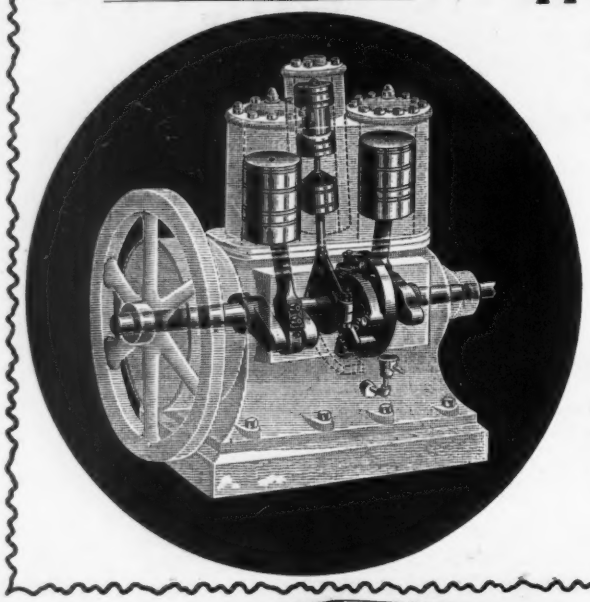

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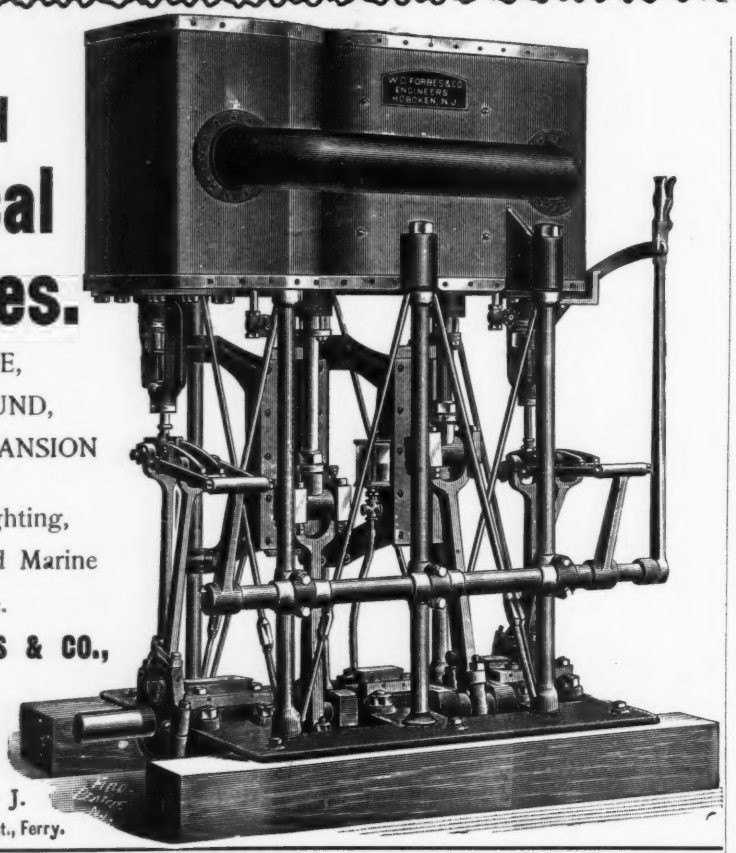

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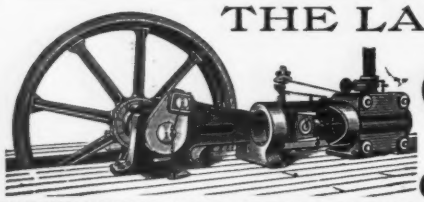

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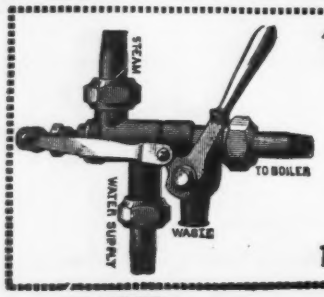

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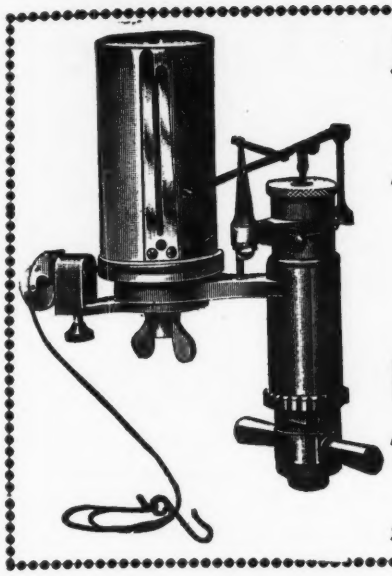

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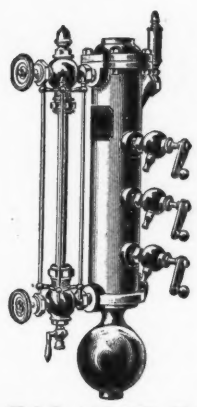

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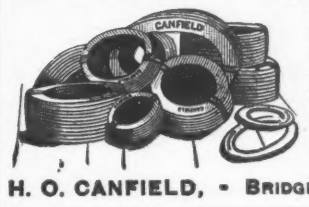

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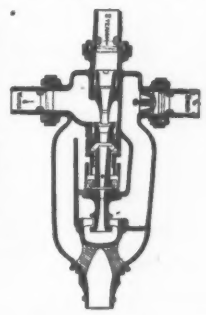

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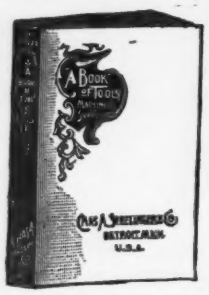

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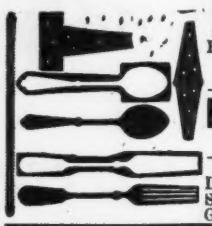

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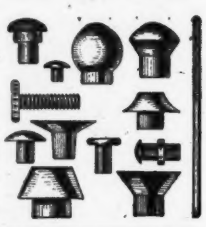

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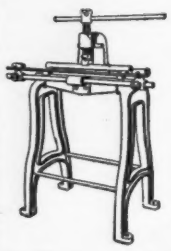

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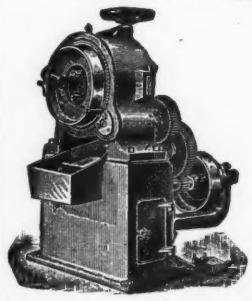

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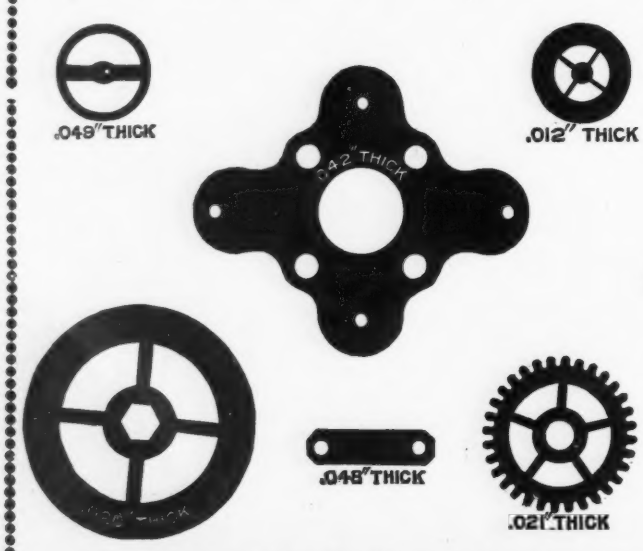

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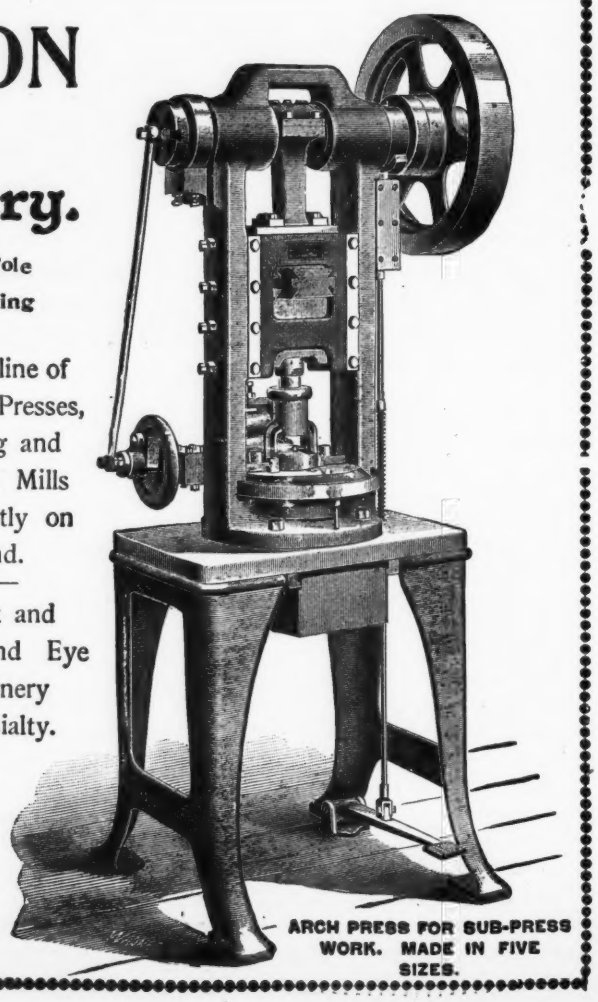

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MACHINERY.

VOL. 1. August, 1895. No. 12.

WORK SHOP ECONOMICS.

THE MILLING MACHINE.

CHAS. O. HEGGEM,

Member A. S. M. E.

ALTHOUGH the milling machine can be made to turn out a greater variety of work than any other machine shop tool, excepting perhaps the engine lathe, and at a very much reduced cost, it is a fact that its general adoption has been very slow. For years after its introduction into the Eastern States it would be conspicuous by its absence in otherwise well appointed shops in the central States. Going from Massachusetts westward, the interest and enthusiasm attending the milling machine would gradually diminish, until, crossing the Alleghenies, it would disappear altogether, and no matter how persistent the efforts on the part of an individual in any one of the larger shops west of this mountain chain, the prejudice against the milling machine seemed impossible to overcome. One shaper after another would be bought and put to work, while a first-class milling machine would be left standing, covered with dust, and not turning the spindle from January to December. Whenever the attempt was made by any one to do something with it, the adventurer would be ridiculed in various ways by the entire shop. In vain would he try to show that this machine was capable of doing a great deal more work, and doing it better than could possibly be done on the shaper; that its prototype had done more than any other tool in the New England States to reduce the cost of manufacturing, and enabled the duplication of parts to a higher degree.

Chas. O. Heggem

It is probable that the reason for the great prejudice against this tool lies in the fact that many shops in the region mentioned had no tool rooms, and those that had would be simply tool rooms in name, places where some drills and taps and files would be kept; but such a thing as an universal grinding machine was not to be found, and as the milling machine depends more upon proper facilities for grinding the cutters—in fact, is more dependent upon a well equipped tool room than any other machine, unless it be the turret lathe—the reason for its early failure is not hard to find. The same cutters would be used for steel and for brass, and without proper grinding, the work on the latter metal would be simply miserable. This indifference to the claims and merits of the milling machine is, however, fast disappearing, and progress and improvements in the methods of doing the work both as regards chucks for holding it and the cutters for the machine, take the place of the old-time prejudice and opposition. As far back as 1887 Mr. N. Lowry made cutters of the form shown in Fig. 1.*

An idea of the size of these cutters is had by looking at the one in the left-hand corner, where a two-foot rule is laid across its face, showing that the cutter is about 13 inches in diameter.

The discs are cast iron, and the cutters are of ¾ by ¼ inch self-hardening steel. The slots in the discs are cut to the neat size of the steel bars from which the cutters are made, but there is no other machine work on the cutters than that of grinding after they are put in place.

The cutters are held by up-setting or caulking, as it were, the cast iron around them, and this form of cutter will do an enormous amount of work at a minimum expense for cutters. As the cutters are quickly made at small cost, and easily maintained, being self-hardening, the temper is never drawn, and they are good until actually worn out.

Fig. 2 represents a variety of parts that are used on a traction engine. They are all interchangeable; that is, hundreds of each are made and used indiscriminately, and at a cost, as compared with planer and shaper work, so greatly reduced that from four to five pieces can now be made for what one formerly cost.

Fig. 3 is intended to show some of the combinations of cutters or "gangs" that can be made to suit different shapes and forms. The illustrations are so plain and the cutters so simple as to render any further explanation unnecessary. Any machinist will take in at a glance what is intended to be conveyed, and if any one has been started on a new train of thought or directed towards a better application of means at hand for accomplishing results, then the time spent in presenting this extract from a list of shop notes on actual experience will not have been wasted.

* * *

HEATING WITH EXHAUST STEAM.

W. H. WAKEMAN.

Judging by what we hear and read on this subject we conclude that some of our friends have either not said all that they intended to, or else are not fully informed as to how the exhaust steam from one or more engines can be used without causing more expense for fuel than would be necessary if live steam were used. It is not worth while for us to occupy any space in showing that such steam is valuable, for we assume that everybody knows this already, but some suggestions as to proper methods for its use cannot fail to be of interest and value. As the first principle to be observed we would note the following. It costs nothing to raise steam to any reasonable height through the exhaust pipe of an engine, but it is expensive to raise water to the same height through the same pipe.

If we wish to carry our exhaust steam to any considerable height, either for heating our shop or factory or for the purpose of heating water, it will pay to put a separator in the lowest part of the pipe so that all of the water will be removed and allowed

* See page 2 for illustrations one, two and three.

to go to the sewer, leaving only dry steam to be raised. If this is impracticable for any cause, then care should be taken to have a sufficient number of drip pans put in so that no body of water can collect at any one point.

On taking charge of a new plant that had been in operation but a month, the writer noticed that at intervals there was a heavy discharge of water from the top of the exhaust pipe, which was some sixty feet above the cylinder. An investigation showed that at the lowest part of the horizontal portion of the pipe there was no drip, consequently water would collect, and when it was partially filled with it the force of the exhaust steam would throw it out at the top of the pipe. A drip-pipe placed at the lowest point cured the trouble.

In another place a discarded cylinder boiler about 30 feet long was set on end on a suitable foundation and used as a water tank. In order to heat the water the exhaust pipe was carried up through it into the air. This was a very poor arrangement, as the water could not be taken out by separator or drip, for the cool water surrounding the exhaust pipe constantly caused condensation, which made a back pressure on the piston at all times. An instance of this kind was reported in one of the mechanical

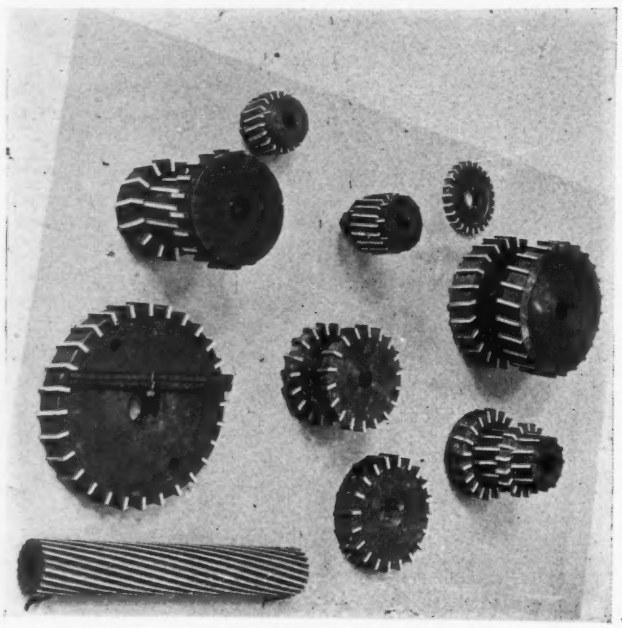

FIG. 1.—WORK-SHOP ECONOMICS.—SEE PAGE 1.

papers some time ago, in which it was related that the back pressure was so great as to make it an unprofitable way of heating water, so that live steam was substituted. It seems to us that this is all wrong, for if the exhaust pipe had been carried up slightly above the top of the tank, but on the outside of it, and then an elbow screwed on, followed by a nipple and another elbow looking downward, and the pipe continued down through the tank and out at the side near the bottom, there would have been no back pressure whatever, for as the steam was condensed it would simply fall, and the effect would be to help the exhaust steam to escape rather than to hinder it.

The second principle that we wish to call attention to is this. The lever of the back pressure valve should never be weighted too heavily. In another paper we read of a case where the editor found a plant where six rooms in a factory were heated by the exhaust steam from the engine, at an expense of two pounds back pressure on the piston, which was called good practice. So far good. After a time no heat was wanted in four of the rooms, and as it took but a part of the steam to heat the two remaining rooms, the back pressure rose to six pounds, at which point the back pressure valve opened and allowed the surplus to escape. This editor proceeds, apparently in grave earnest, to tell us that this is wrong, and it would have been cheaper to let the exhaust go to waste and heat with live steam. Now if two pounds pressure will send the steam through the heating pipes at one time,

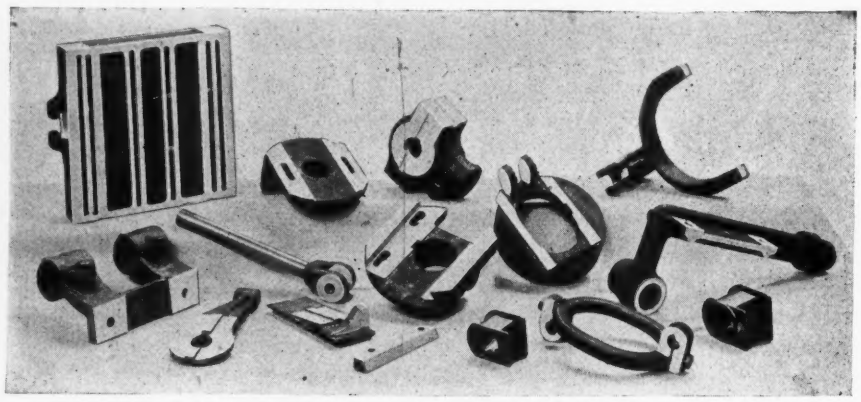

FIG. 2.—WORK-SHOP ECONOMICS,—SEE PAGE 1.

we see no reason why it will not do so at others; therefore we suggest that instead of weighting the back pressure valve so that it will not open at less than six pounds, it be set at two and one-half or three pounds, for the idea that it is necessary to carry six pounds is perfectly absurd. If such directions were to be followed, the loss of fuel would be large and, what is worse, would be entirely uncalled for. A back pressure valve is simply a safety valve made to open at a low pressure, and the pressure at which it must operate is not arbitrarily fixed, but, as in the case of the safety valve, may be varied at pleasure.

A certain mill owner had an engine that was capable of developing 125 horse power when at its best, but after a time it was unable to keep up its regular speed when the full load was on. An investigation of the conditions and an application of the indicator showed that the back pressure above the atmosphere was equal to a load of 35 horse power, almost the whole of which was caused by the mill hands hanging iron weights on the back pressure valve lever, because they thought that it made the room warmer by so doing. When the engineer in charge was spoken to on the subject, he replied that the back pressure valve was not in his jurisdiction; and if this was true then the jurisdiction should be enlarged or the valve brought nearer headquarters, and if not true then it showed an effort to avoid an exposure of ignorance, which was unsuccessful.

I was much surprised to read an article a few days ago, written by a well known expert on steam heating, which said that a gate-valve should be located in the exhaust pipe of the engine, so that it may be used to prevent any possible escape of steam, but cause it all to go to the heating coils. Of course this can do no damage unless it be to burst a weak pipe or something along that line; but it is decidedly objectionable, because even the boiler pressure cannot open it, and in all cases this valve should open and reduce any undue pressure of steam that may accumulate for any cause, as otherwise it is of no value.

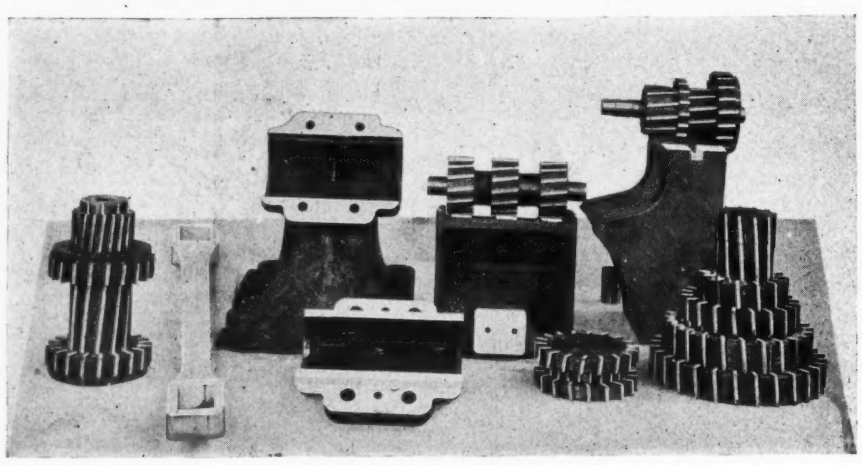

FIG. 3.—WORK-SHOP ECONOMICS.—SEE PAGE 1.

The third principle that we wish to speak of is as follows. In erecting a plant where the exhaust steam is to be used for heating, the pipes should be of an ample size to allow free circulation

of the steam. As a rule it is not good practice to put steam traps on the outlets of exhaust heating systems, but unless the water is pumped back into the boilers, it should be allowed to freely escape to the sewer, for attempts to "bottle it up" only result in poor circulation and cool pipes. This of course does not apply where this water is caught in a tank which has a large, free outlet at the top.

If it is desired to convey the steam a long distance before using it do not attempt to economize by putting in a bushing and using small pipe, for the results cannot be satisfactory under such circumstances; and as for the economy of using small pipes and few of them in the rooms to be heated, we can only say that the more heating surface we have, the more heat we shall get from our steam and the more satisfactory will be the results. It should be so planned that a part of the system can be shut off in mild weather.

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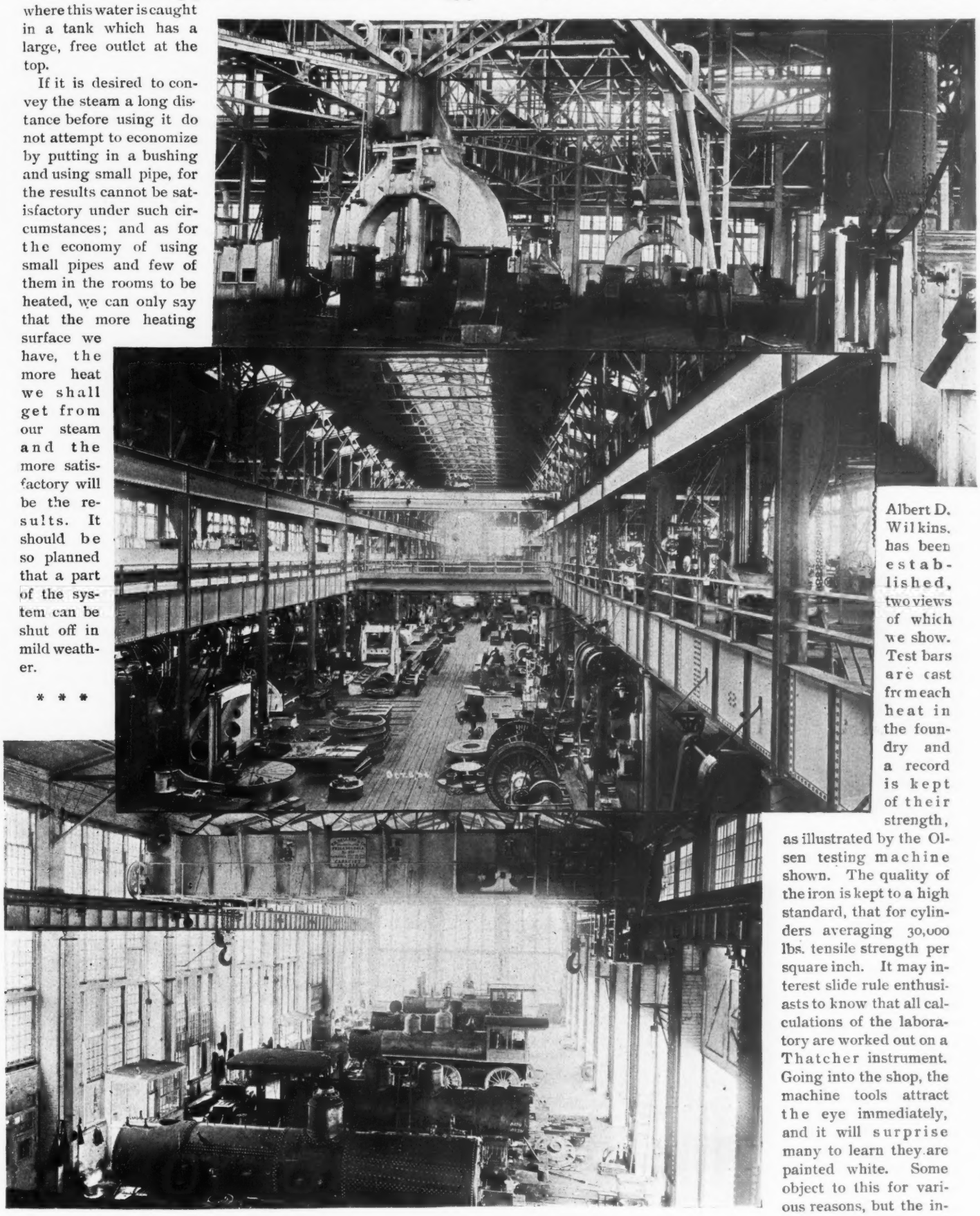
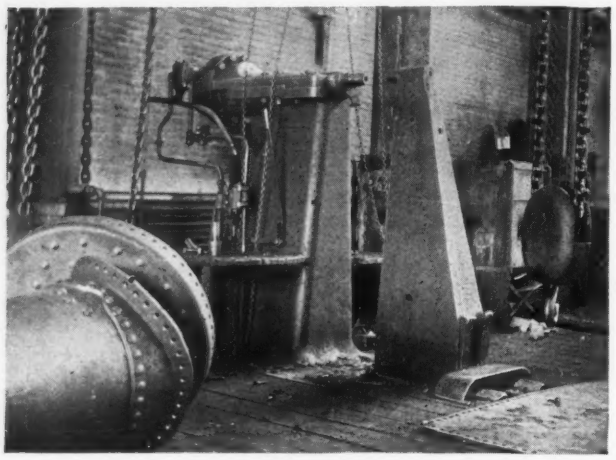


HAMMER, MACHINE AND ERECTING SHOP.—PITTSBURG LOCOMOTIVE WORKS.

AMONG THE SHOPS.

THE PITTSBURG LOCOMOTIVE WORKS, of which Mr. D. A. Wightman is Superintendent, show what a reformation it is possible to accomplish in an old establishment when the right kind of a man is in charge, and from a poorly equipped shop twenty years ago it has grown to a modern locomotive shop, with new buildings replacing nearly all of the old ones, and an outfit of tools which places it on equal footing with any shop of its size in the country, and far ahead of some which are larger. Modern ideas prevail, and a well equipped laboratory, in charge of Mr. Albert D. Wilkins, has been established, two views of which we show. Test bars are cast from each heat in the foundry and a record is kept of their strength, as illustrated by the Olsen testing machine shown. The quality of the iron is kept to a high standard, that for cylinders averaging 30,000 lbs. tensile strength per square inch. It may interest slide rule enthusiasts to know that all calculations of the laboratory are worked out on a Thatcher instrument. Going into the shop, the machine tools attract the eye immediately, and it will surprise many to learn they are painted white. Some object to this for various reasons, but the increase in the volume of light is more than one would imagine, and its practical advantages outweigh any æsthetic objection, as it makes visible all the floor surrounding the tools, showing all bolts, washers, etc., which may be dropped. It also aids men in seeing their work, and considering that the tools have not been painted in three years, they look remarkably

well, the inevitable yellowish stain from the oil being the only disfigurement. Each tool is numbered, as can be seen in some of

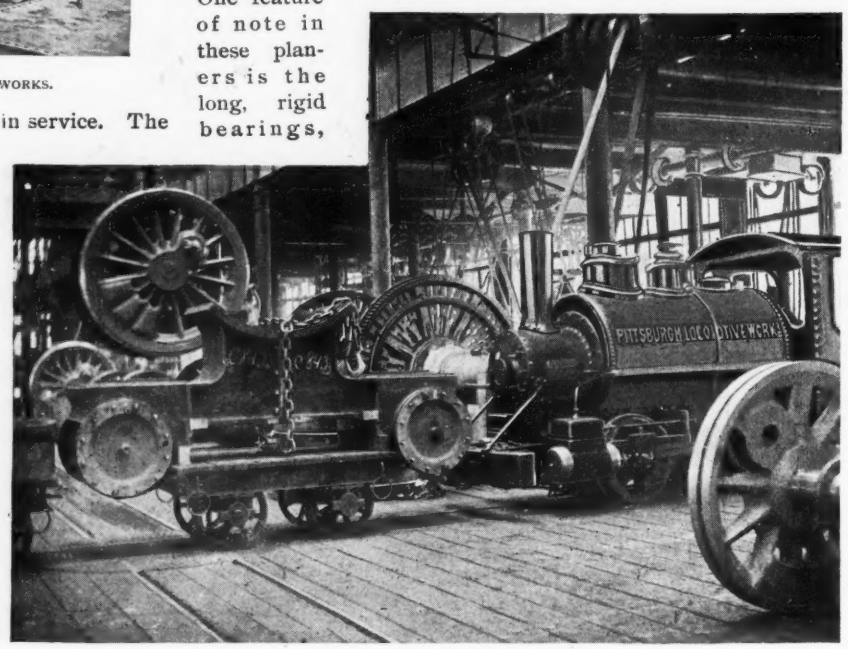


THE OLDEST RIVETER, PITTSBURG LOCOMOTIVE WORKS.

the views, and a record kept of repairs and time in service. The view in the main shop shows the centre aisle, the galleries and the traveling crane, the track for the shop locomotive being seen down the center. The smaller one shows the locomotive handling a car containing a pair of cylinders, while the pair of driving wheels are being handled for the wheel lathe by the overhead crane.

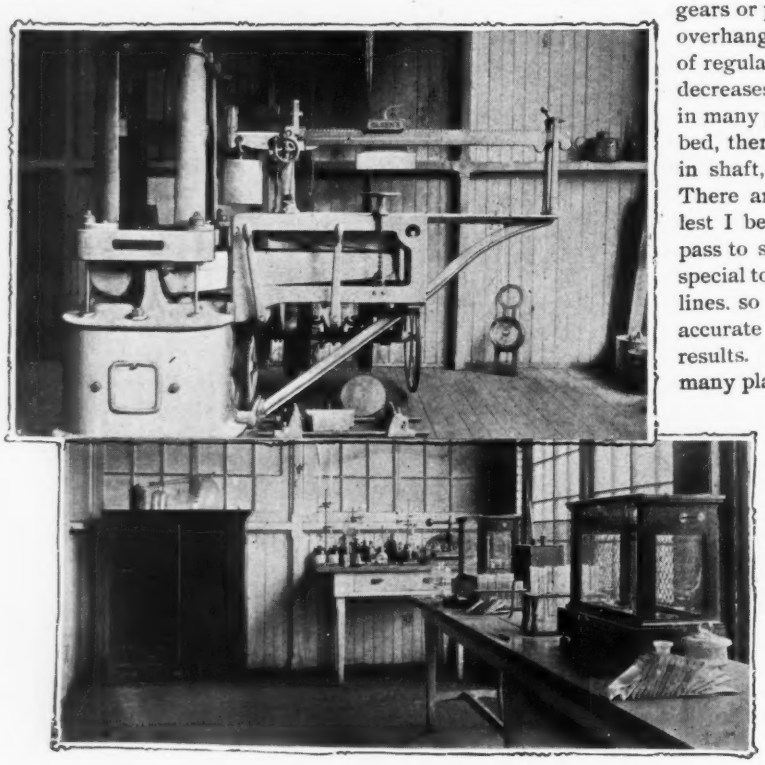
Cutting speeds are well considered here, and on planers this varies from 25 to 33 feet per minute, with the former most in use, as most of the cast iron is close grained and hard. Boring bars are run at from 12 to 16 feet per minute on cylinder work, with the bars made heavy enough to stand a good chip, an 18 by 24 inch cylinder being bored, counterbored and faced in from five to six hours, which far exceeds the ordinary boring speeds. The erecting shop is served with an 80 ton crane of the Sellers make, with two hoists as shown. The large percentage of window space here makes a very light shop. The hammer shop is also well equipped with cranes and overhead tracks for handling material, as can be seen by carefully following the details in this shop. An interesting tool, which might perhaps be called a relic, is the old riveter shown. It has a 6-foot gap and is said to be the first riveter of the kind built by Bement, Miles & Co., being originally intended for steam, but now used on the hydraulic system with the others. This tool is doing good work, within its capacity, and also serves to show the advances made in size and capacities of tools.

THE POWELL PLANER CO., of Worcester, Mass., occupies part the same building with Prentice Brothers, and those who have followed the discussions relating to the new form of thread, with its 29½ degree angle, the same as the adopted angle for worms, will recognize and appreciate Mr. Powell's work in the matter. The details of this planer are well known, and can be studied with profit by the student of machinery in its various practical forms, as they show the handiwork of a machanic as well as a designer. We hope to have some of Mr. Powell's practical ideas on machines and machine design for the future issues of MACHINERY, so that little will be said regarding them at present. One feature of note in these planers is the long, rigid bearings,



THE SHOP RAILWAY—HANDLING A PAIR OF CYLINDERS, PITTSBURG LOCOMOTIVE WORKS.

many times the shaft diameter in length, the space between gears or pulleys being all utilized as bearing, instead of having overhang or unsupported shafting, in order to make the bearings of regulation length. This insures good, cool running shafts and decreases wear, and is a point that can be followed to advantage in many places. All gearing is concentrated directly within the bed, there being no overhang and little chance for undue torsion in shaft, besides being well protected from dirt and accident. There are many other interesting features in this machine, but lest I be charged with advertising this particular planer, I will pass to some of the methods used in its production. Jigs and special tools have been well considered and are based on practical lines, so that without being unnecessarily expensive they are accurate and do their work in a manner that insures accurate results. All jig work is not of this character, however, and in many places we see elaborate jigs which have cost a great deal to make, but which are not based on correct principles, and which cannot give entirely satisfactory results. They denote, however, an attempt in the right direction, and should be considered as such.



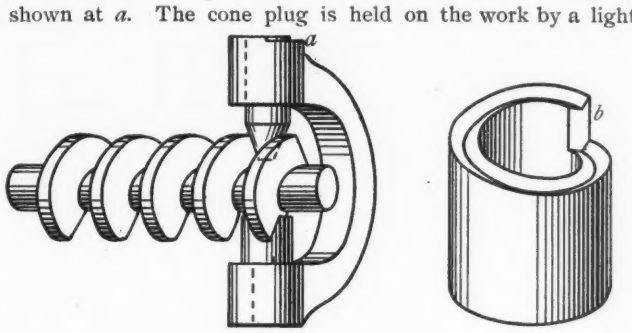
TESTING MACHINE—A CORNER IN THE LABORATORY, PITTSBURG LOCOMOTIVE WORKS.

All supplies are kept in boxes or drawers, and each has a cost-mark, so that when they are delivered to the different jobs the cost of parts is known to the one in charge of the supply room and charged to that job. The prices are marked on tags and tied to one of the pieces in the drawer, making it easy to see the cost and also useful in giving the workman an idea of the cost of various articles, with the possible effect of making him more careful about mislaying or losing bolts, set screws, etc.

The drawing room has much of interest, especially to an amateur photograph fiend like myself, as Mr. Powell is also one of the wicked kodakers, and applies his skill to commercial uses in connection with the shop work, illustrating

etc. In this connection it will be well to mention a very interesting collection of views of ancient and modern planers, the collection being made for the use of his class in mechanical drawing at the Mechanics' Association of Worcester, and showing the various ideas of different designers. In making drawings, bond paper is used and the drawing penciled and inked on the original sheet, which is then used to blue print from. In this way there is but one drawing made and no tracing is done; one objection, though not a serious one, being that the bond paper does not give as clear a blue as tracing cloth, although it answers every purpose.

EDWIN HARRINGTON & SON, of Philadelphia, have many interesting features, mostly due to the new management, a few serving to show the ingenuity and mechanical ability which is made use of in turning out accurate work at a minimum cost. In fact it is cheaper under present methods to have work accurate than otherwise, strange as this may seem to those who are not acquainted with the best practices of the day. The broaching process employed here has already been described in other journals, where the hubs of chain sheaves for hoists are broached out square at one passage of broach, making a cheap and sure method of preventing its turning on the shaft. Phosphor bronze worm wheels are used, the edge and sides of rim being finished by milling with straddle mills, which makes a rapid method of turning these out. The worms are gauged in a very interesting and ingenious manner by a special form of limit gauge designed by Mr. Mac Gregor, the superintendent. This is shown in the accompanying cut, and is of the regular U form used for micrometers, with the lower plug swiveled to adjust itself to the pitch of worm. The special feature is in the "limit" device, and is shown at *a*. The cone plug is held on the work by a light



spring, and when this gauge fits the worm so that the end of the plug is flush with top of gauge, the worm is the right size; when it is small enough to allow the plug to drop to the lower edge of the offset the limit has been reached, and anything below this condemns the work. This application of the limit principle is novel and has the desired effect of producing accurate work.

The advantage of grinding tools without altering their shape is being generally recognized, and its application to a facing tool of special shape is shown beside the worm. By grinding on the face *b* the tool can be sharpened many times and still retain its shape and rake of cutting edge. Below this is shown a device for holding such work as reamers, taps, etc., while the shanks can be neatly marked with a stencil as desired. The two views leave little to be described. The tool is held in the center of the inner sleeve which is free to turn, but prevented from end motion by the plug *d* fitting in either of the grooves shown in the sectional view of the sleeve. The stencil being placed through the opening *c* and struck with a hammer prints the first letter, then turning the sleeve the required distance the next is struck, and so on until the name is stamped *all in line* on the tool. If a second line is wanted the plug *d* is pulled out, the sleeve moved to the next notch and the operation repeated. As a cheap adjunct to the tool room this is very handy and gives good results.

* * *

SYSTEMATIC shop management is productive of the best results when the system is based on correct mechanical and social principles. Cast iron rules are generally worse than useless.

COUNTERBALANCING.

W. H. BOOTH.

The balancing of a machine is so simple a matter that it is rather surprising so much should be said and argued about the subject. Probably the reason lies in the fact that so important a machine as the locomotive is one that receives most attention. Now a locomotive of the ordinary build cannot be balanced for the simple reason that the disturbing parts requiring to be balanced are reciprocating pieces moving on straight lines, and it is sought to balance them by weights placed in the wheels. But for such irregularity as is produced by the connecting-rod upon the movement of the piston, a very close balance may be secured so far as regards horizontal movements and the solidity of the road-bed may be trusted to absorb the vertical unbalanced action of the balance weights themselves. This procedure would probably settle the whole question but for two or three facts. First, the road-bed is sometimes upon a bridge and very destructive vibrations are liable to be caused by the counterweight action. Secondly, the pressure of any one wheel being the limit of stress on the rail, is very seriously increased by the counterweight action, and so far as the rail is concerned the stress produced is equivalent to that which would be produced by a locomotive of considerably greater weight. The weight on a wheel may be 20,000 pounds; the counterweight action may add another 20,000 pounds, while the sudden application of the load to the rail practically doubles the actual weight. The stress on the rail is thus equivalent to 60,000 pounds as against the equivalent of 40,000 pounds in a balanced wheel. Thirdly, the wheel may be actually lifted from the track at high speeds. The obvious remedy, in the locomotive, is to employ more cylinders with moving parts of equal weight and opposite motion, so as to be self-balancing—a complication not likely to be considered at present.

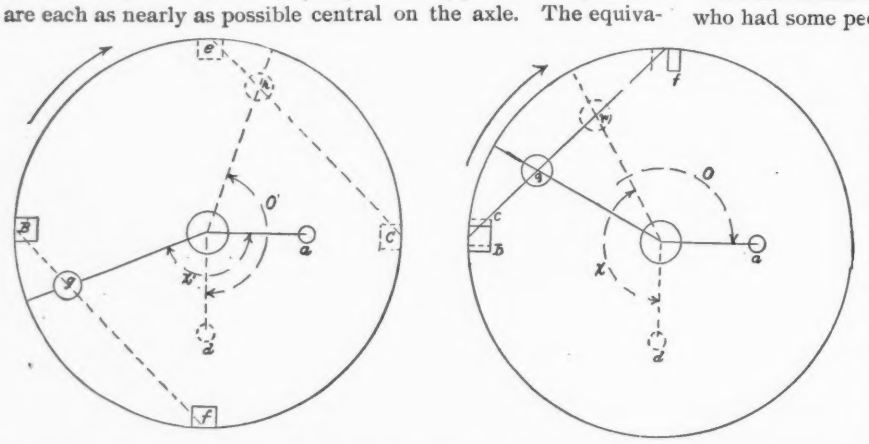
For stationary engines, however, of ordinary types with good foundations, there is no objection to the introduction of the vertical action, and such engines can usually be fully relieved of horizontal movements or tendency to move, by properly designed counter-weights. Nevertheless, we may often see cases where the true art of balancing is not carried into fact. A moving weight can only be balanced by another weight that moves in the same plane. Now in a steam engine the movement of the disturbing parts takes place in the plane in which the crank-pin revolves. The best practical single counterbalance that can be applied is one in the crank itself, and when carried out usually takes the form of a tail to the crank. This tail revolves in a plane a few inches removed from the center of the crank-pin, and there is thus set up a disturbing couple which tends to cause the shaft to oscillate in a horizontal direction. Usually this force is small, and the crank-tail is a fairly practical solution and very superior to the plan of placing a weight in the fly-wheel some feet distant from the crank-pin. The twisting couple then has a much greater moment, and the plan is to be avoided as little better, if any, than no balance at all. If, however, an exact balance is wanted in the horizontal plane, this can always be secured by employing two balance weights moving in suitable planes.

There are then three disturbing forces, the piston and the two weights. Of the two weights one will be in the crank and one in the wheel. That in the crank will be the heaviest and equal to the sum of the weights or the balance in the wheel, and the moving parts to be balanced and the ratio of the two outer weights will vary inversely with their distance from the intermediate weight. Thus an engine whose moving parts weigh 91 pounds is fitted with a tail crank whose center of gravity revolves at a distance of 4 inches from the crank-pin. The second weight in the wheel is 28 inches from the crank tail. Thus the horizontal distances from the middle weight are as 1 to 7, and the weight in the wheel will be one-seventh of 91 pounds, or 13 pounds. The sum of these is 104 pounds, and this is the weight of the crank tail. Any change of the radius in revolution of any one weight varies inversely as its weight, but this is always to be first assumed to revolve in the crank-pin radius. In the old days of stone milling the balancing of the mill-stones was effected by placing weights in pockets in the circumference of the stone, and this was done so that the stone hung true when at rest. It was assumed by some that a standing balance was also a running balance, but facts disproved this assumption, and it was perceived that a stone weight might be made to hang truly when at rest by placing the balance weights either

near the top or bottom of the stone, but that when running the couple set up would throw the face of the stone out of the horizontal, and it was found necessary to correct this by lowering the weight nearer to the bottom edge upon that side which dipped when running, so as to form a couple tending to raise the dipping side.

Despite the fact that all these things have been a matter of practical observation for many years, it is still easy to see that there is a very general ignorance of the mechanical fact that a revolving body tends to revolve round its center of gravity, and that the common center of gravity of two bodies lies in a line joining the two bodies and distant from each inversely as their respective weights. From this it follows that to balance a locomotive in the horizontal plane each outside cylinder will require a heavy weight in the near wheel directly opposite the crank-pin and a light weight in the far side wheel on the same side as the crank-pin. Thus there will be two balance weights in each wheel for which a single larger weight may be substituted on the radius of the common center of gravity. The resulting weights will not come exactly opposite the crank-pins, and on one side of the locomotive the balance weight will lead or follow the crank-pin by $180° \pm x°$, and on the other side will follow or lead by the same amount, $x°$ usually being about 15 degrees. Fortunately this does not prevent the reversal, end for end, of the axle with its wheels, as the weights will still be right whichever side of the engine either wheel may occupy. Rankine's rule that the counterbalance should be upon a radius bisecting the angle between the two cranks is not correct.

For inside cylinder engines there will still be a balance in each wheel, but they will be, for each crank, opposite the crank in both wheels, and more nearly equal in weight as the cylinders are each as nearly as possible central on the axle. The equivalent single balance weights in each wheel are found exactly as in the case of the outside cylinder engine, and the final relative positions as regards angular lead are the same except that the crank-pin of the inside cylinder represents the weight in the wheel of the outside cylinder, and vice versa, the wheel weight represents the outside cylinder, so that where the balance weight leads the crank-pin of its wheel in one case, it follows in the other case.



The use of the three cylinders in a compound locomotive with the two outer pistons moving together in the same direction, and the piston of the central cylinder moving exactly opposite and having double the weight of each outside piston, would completely solve the question of locomotive balancing. It is only at high speeds that the matter becomes really serious, and, it may be asked, is the placing of cranks at 90° an absolute necessity? In stationary practice it is by no means universal, and large engines are turned off their dead points when starting by means of small engines termed "barring" engines, by reason of their having replaced the crowbar formerly found sufficient for the purpose. A small engine at a high speed would similarly move a locomotive off its dead point, and the effect of abolishing the time-honored placing of cranks at 90° would be absolutely unfelt at high speed.

In the high speed Willans engine so much used in English electrical work, there are three cranks at angles of 120°, with balance cranks, and the want of absolute balance is not perceived though frequent charges of vibration are made in houses at some distance. These are probably due to horizontal effects that cannot be eliminated.

In a locomotive, seeing that the only object of balancing is to preserve the centre of gravity of the whole engine in one spot, it is of no matter if a portion of the perhaps too heavy counterweights are transferred, in a coupled engine, to the coupled wheels. The vertical or hammer blow action will be modified and distributed and the severity of action on the rail reduced.

It has been argued that because a body revolving freely will revolve about its centre of gravity, therefore the placing of a counterweight in a wheel will tend to cause such wheel not to revolve about the center of its axle, and that the intended action of the counterweight will be lost. This is not so. A locomotive wheel is compelled to revolve about its center by the constraining effect of the axle box and of the rail, and it is to the endeavor of the counterweight to compel a different center of revolution that its effects are due.

Every plan of balancing can be reduced to a mere statement of weight and lever arm. There is no need for any elaborate mathematics being spilt over any counterweight calculation. Such only serves to obscure an otherwise perfectly plain issue.

In the locomotive the weight of the valve gearing is neglected. The counterweights for these should be found in each wheel for the most likely position and travel of the valves at a high speed, and then the final counterweights should be worked out equivalent to the four weights. The valves are really too heavy to be neglected and are doubtless a fruitful cause of failure to secure an easy working engine. The result of allowing for valve motion effects is to decidedly vary the angles x and o between the crank arms and the equivalent single balance-weight. It is sufficiently important not to be neglected.

* * *

NOTES FROM NOTOWN.—2.

We had a new secretary and business manager a few years ago who had some peculiar traits, and though no doubt he was a good business man, he didn't know a slotter from a boring mill unless he looked it up in a catalog before he came into the shop, and the fool part of the whole thing was his thinking that the proper management of the shop rested on his little sloping shoulders. He was a reformer from the head down, and the changes he was going to make were startling, to say the least. First the boiler room was nosed into, and the fireman allowed a certain pile of coal, about half the usual quantity, and as a result the steam gave out and the shop shut down for the day. That settled his energy in that direction, and the oil bill next attracted his eagle eye as "entirely too large." Oil supply was restricted and hot bearings were the rule rather than the exception, while he gloried in the economy. The superintendent finally had a quiet interview with the president, who had horse sense if he wasn't a mechanic, and told him some of the fool performances that were going on, with the ultimatum that if the new manager wasn't chained in the office where he belonged, they'd better find a new superintendent. "But he is a big stockholder, Mr. B., and his suggestions must be considered and controverted if not practical." "How can you convince a man who knows nothing but figures, that a pound of coal won't give half a horse power in this plant when he has seen some test which showed this economy? How does he know that a planer tool won't cut 40 feet a minute on steel just as well as 20, 'if you only whoop her up,' as he says?

"He told one of my apprentices not to use oil on the thread he was cutting—'too expensive,' and as a consequence the screw was roughed up and so we had to throw it away. Now see here, Mr. President, I may not be perfection, but if I can't run a shop for less money than any office man you ever saw, I'll quit to-night, and I will anyhow if any one is going to give orders to my men except through me. If Mr. S. is willing to shoulder all the responsibility and direct things generally, he can run things as he pleases; but I don't accept responsibilities for other men's foolishness." Well, to cut it short, Mr. B. quit and a new man came, a tech. graduate who had the making of a good mechanic in him, but he was unfortunate in being backed by the new manager, and his practical education was mighty expensive.

Two reformers together can raise Cain about a shop, and the next few months saw wonderful changes in the Notown Iron Works. New machinery was bought, some mighty good tools, too, but lots of them were not adapted to our work, while some tools that should have been replaced were decided as all right·

Combinations were in order, and a machine made for finishing engine frames, which planed the ways, bored the shaft bearing, etc., and finished it complete. Great scheme, but when it lay idle for a month and then was run a few days, the money invested as well as the room occupied would have paid for handling from planer to horizontal boring mill, and had the use of both during all the idle time of the other. Other similar cases might be cited, but this is a fair sample, and it isn't confined to our shop, either. Improvements continued and the reformers had lots to show the visitors, but when the first stockholders' meeting was held there was war. "Necessary improvements" came in for a large share of the expense, but when the cold-blooded time-keeper, who kept accounts straight regardless of reform, showed on the cost sheets that several parts of the work were costing more than before, the "new management" were called to account. Improved machines are all right and necessary, but it takes *sense* to select them and use them so as to make them pay. Some of the important details had been neglected, and the old cylinder boring mill was pronounced O. K.: "'Twas so flexible and convenient," but it took twice the time it should and the work was never round or uniform. Right here it may be well to state a principle, which is simple, but apparently not well understood. *The secret of good work and lots of it is in having both the work and the tool well supported.* A light boring bar with the tool held in a spider at some distance from it, is bound to spring and cannot stand the cut that should be taken. But to resume. The handling of material, being an important item, had received attention, but, as with the other reforms, they had tackled the wrong end of it, and instead of having cranes and hoists for the machines used the most, these were left for the laborers, while the seldom used machines were well equipped. There is lots of this done elsewhere, and the moral must be plain, that in shop management as well as other places, it is best to get a good practical man for the work in hand and not have him bothered by somebody else nosing around who only has a smattering of the business.

There was another change, and Mr. B. came back again, to be unhampered by Mr. S. or anyone else, and peace reigned once more, until one of the new foremen had to walk the plank. He was a hustler, and had made a practice of getting out lots of work, but when Mr. B. overheard him tell a man to smash a bolt-thread with a hammer to make it tight, his time had come, and another hustler had shown one of the secrets of his hustle. Since then there has been no trouble, and Mr. B., though rather old and not always as progressive as he might be, keeps things in motion, and considering all the questions to be thought over and decided, which, if decided wrongly, means loss of money to the firm and not very pleasant feelings to oneself, I don't know as I want to swap jobs, although I would like to make a few changes in some of the tools and methods of doing work.

ICHABOD PODUNK.

* * *

MORE ABOUT CYLINDER BORING.

Additional data has been furnished by Mr. Thomas regarding the accuracy of cylinders bored in the shops of the Westinghouse Machine Co. The cuts published last month will aid in following these figures.

Sample of dimensions taken in the shop, from which the cuts are filled out. Cuts or slips are turned over foreman of erecting shop, who adds the engine number on which the respective steam chests are placed, are then turned in to the office and placed in record book against same engine number.

12 AND 20 x 12 INCH STEAM CHESTS S. O. 484.

No.	1st Rib.	2d Rib.	3d Rib.	4th Rib.	5th Rib.	6 h Rib.	End to Steam Line.	Length over all.
	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.
1..	9.3085	9.309	9.2485	9.2485	....	....	....	....
	9.309	9.309	9.249	9.249	9.249	9.249	....	....
2....	9.309	9.309	9.248	9.248	9.248	9.248	....	....
3..	....	9.3105	....	9.2485	....	....	....	....
	9.311	9.3115	9.248	9.248	9.248	9.248	....	....
4....	9.311	9.311	9.248	9.248	9.248	9.248	....	....
5....	9.311	9.311	9.248	9.248	9.248	9.248	....	....
6....	9.311	9.311	9.248	9.248	9.248	9.248	....	....
7....	9.311	9.311	9.248	9.248	9.248	9.248	....	....
8..	9.3115	....	9.247	....	....	....	....	....
	9.312	9.311	9.248	9.248	9.248	9.248	$10\frac{7}{32}$	$31\frac{11}{32}$
9..	9.310	9.310	9.247	9.247	....	....	....	....
	9.312	9.311	9.248	9.248	9.248	9.248	....	....
10..	9.310	9.310	9.247	....	....	....	....	....
	9.312	9.311	9.248	9.248	9.248	9.247	....	....
11..	9.3105	....	9.247	....	....	....	....	....
	9.3115	9.311	9.248	9.248	9.248	9.248	....	....
12..	9.3115	....	9.247	....	....	....	....	....
	9.3125	9.311	9.248	9.248	9.248	9.248	....	....

13½ x 12 INCH CYLINDERS AND STEAM CHEST S. O. 485.

No.	R. H. Cylinder. Across.	R. H. Cylinder. Longitudi'ly.	L. H. Cylinder. Across.	L. H. Cylinder. Longitud'ly.	Top.	1st Rib.	2d Rib.	3d Rib.	4th Rib.
	Inch.		Inch		Inch.	Inch.	Inch.	Inch.	Inch.
1..	Top .. 13.500	x 13.500+	13.502	x 13.504	9.499	7.997	7.997	7.996	7.996
	Bot... 13.503	x 13.502	13.501	x 13.502					
	Average 13.501		Average 13.502						

12—20 x 12 INCH CYLINDERS S. O. 484.

No.	H. P. Cylinder. Across.	H. P. Cylinder. Long.	L. P. Cylinder. Across.	L. P. Cylinder. Long.	Internal Cylinder. Across.	Internal Cylinder. Long.
	Inch.		Inch.		Inch.	
1.....	12.003	x 12.003	20.004	x 20.007	11.999	x 12.000
	.004	x .003	.005	x .007	11.999	x 12.000—
	.004½	x .004½	.005	x .006½	12.000	x 12.000—
	.004	x .003½	.006	x .006	12.000	x 12.000+
	.003	x .003½	.006	x .006½	12.001	x 12.001
	12.003+	x 12.003+	20.005	x 20.006+	12	12

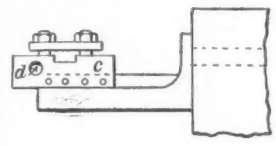
* * *

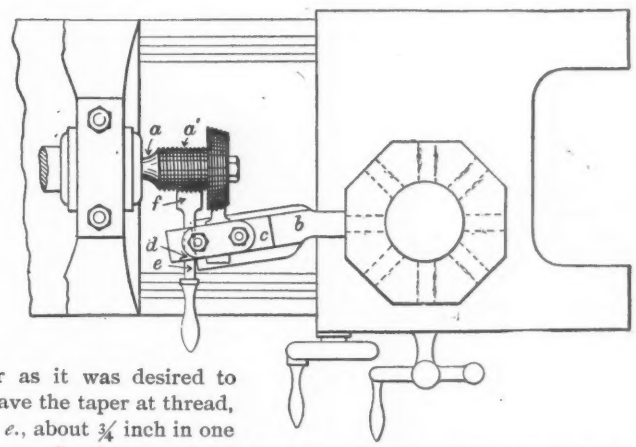
A TURRET TOOL.

WM. O. WEBBER.

One of the handiest "shop kinks" I know of is one to cut taper threads in an ordinary turret and was used to thread the edge of some valve seats which were to be screwed into a cast iron body and of course must be perfectly tight.

In the spindle of the lathe was inserted a taper shank holder or chuck *a*, with an enlarged part a^1, each rather longer than would have been necessary if this was to be used solely as a chuck—this larger portion was threaded to 11½ threads per inch and then hardened thus serving the part of a "master piece." In one of the holes in the turret was inserted a tool carrier on whose upper surface was placed a boss with inclined, slides *b*, these slides being at the same angle to the axis of the shank of this holder as it was desired to have the taper at thread, *i. e.*, about ¾ inch in one foot. On the top of this boss was fitted a sliding tool block *c*, with gibs on a taper to take up all lost motion.





This tool block carried a chasing tool of the proper number of threads per inch corresponding to the "master piece" and the face of the chasing tool was set to the same angle as that of the slide. In the end of the slide opposite the "master piece" was a hole *d* at right angles to axis of lathe, through this hole passed a rod having a threaded block *f* (preferably made of soft metal) on its extreme end to engage with the master thread. This rod was considerably longer than the distance through the hole in block to allow for the angular travel of slide and also difference of adjustment of chaser and diameter of valve seats, and on its outer end carried a handle. In operation, the turret was run up into approximate position and clamped fast to ways of lathe. The turret was then fed up by hand cross feed until chasing tool would just engage face of seat; the "guide rod" was made to engage with the "master piece" drawing the slide with it, and was then alternately engaged and disengaged, the lathe running forward all the time and the slide slid back to take new hold by lateral pressure of left hand. The right hand feeding up the turret until the thread was cut deeply enough and to size.

* * *

THERE is more in using a hammer of the right weight, than some men seem to think.

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AUGUST, 1895.

THIS issue of MACHINERY completes the first volume. Beginning with September the number of reading pages will be doubled, the contents very greatly improved, a number of new and valuable features added, and the price raised to one dollar a year. Subscriptions received before September first will be entered at the present rate, and we suggest that our readers make this fact known to any of their friends who may be interested, as it practically amounts to getting a dollar's value for fifty cents. Club rates have been raised to correspond with the new price and no clubs will now be received at the former rates. Most publications cut off the club rates for renewals, but we shall be glad to have our friends who have raised clubs for us in their shops send us renewals as they mature, at the above rates, which are proportionately the same as last year.

WE frequently receive requests to examine indicator cards and answer questions of various kinds which do not contain half the necessary details, and very often are without the writer's name and address. We are pleased to give any information possible on subjects of general interest, but not being mind readers, nor caring to guess at conditions, we must have details and names and addresses of inquirers. We are now prepared to answer practical questions pertaining to shop and engineering practice, but shall not undertake to design machinery or to give advice on subjects foreign to our field. Give all the details you have and if the question is in our line, we will answer it or acknowledge our ignorance of the subject.

* * *

MODERN MACHINERY AND METHODS.

We often hear complaints from shops in various sections of the country regarding the departure of work in their line to other localities, and attributing it to various causes, usually all but the right one. A careful observer who sees the different plants will be impressed with the difference in tools and appliances, and with few exceptions the prosperous places are the ones best equipped for their work, with improved machinery and methods, and wide-awake mechanics.

The exceptions owe their failure to poor management in some essential particular, investing in tools more heavily than circumstances warranted, or in tools whose work is limited as to variety, and must lie idle so much as to make an unprofitable investment. These points need to be very carefully considered, and probably differ in each case. Shops abound where the tools have been used for twenty years and are fondly preserved as relics, but they usually lose money every day, although there are a few exceptions to this rule. Lathes "just as good as new" should give place to others which can produce more and better work as soon as the saving that will be effected makes it profitable to do so, whether the old lathe has been in use one year or a hundred. The shops that are falling behind in the race are those whose equipment is no better or is worse than it was last year, and this is almost independent of location or other conditions except the one of tools and good management. When we see out-of-date tools nibbling away at a piece of work, with enough vibration to remind one of a man with palsy, it is safe to say that the shop next door, with a modern tool which can cut from two to ten times as fast, can underbid it on work of any kind or can make a larger profit on work at the same price. These are the determining factors in machine production to-day, outweighing all others, even the cost of labor; and the sooner it is recognized by all builders the sooner will they find prosperity and fatter pocket-books. It is time to stop bewailing a fate that is caused only by a lack of modern ideas and tools, and which can be more easily remedied now than later. This is one reason for the usual success of new shops with new equipments, and their continued prosperity depends on a continuance of these conditions, namely, in keeping their equipment as near abreast of the times as possible.

* * *

THE opinion of a good workman regarding a new machine or tool, is often of much value in selecting a new equipment for the shop, and a wise superintendent or purchasing agent will take advantage of the advice whether he follows it or not. Although the superintendent is supposed to be versed in all modern machinery, it often happens for various reasons that he is not, and even if the workman does not know of a better machine, he can at least point out the defects of the one he is running, which can be looked after in the next one purchased. Show him his opinion is appreciated and he will make it of value.

SLIDE VALVE STUDY.

ROBERT GRIMSHAW.

Among the many devices which I have tried for the purpose of aiding me in the study of the slide valve and the solution of practical problems in the use of that important member of the steam engine, is one which I describe here and which is so simple as well as effective, that it deserves a place in every engine-room.

It was desired to have some rig or other which should tell at once how much lap to give to cut-off at a given point with a certain valve-travel; or how much valve-travel to give to cut-off at a given point where the lap was a certain amount, or where the cut-off would come, under stated conditions of lap and travel, etc., etc. The device must be something free from high geometry, must be not only cheap, but capable of being "home-made" without any special tools, and must not be bulky or heavy. The one which I hit upon at last was made about as follows:

I took a large square of card-board, and laid off thereon a quadrant of 25 inches radius. In this I inscribed a number of concentric quarter-circles at equal distances apart. Parallel with its two radii, I drew a number of equidistant lines. Then I took a piece of linen tracing-cloth about 8 by 12 inches and drew on it, about 8 inches from the left-hand end, a semi-circle with diameter vertical and about 6 inches in diameter. On the same diameter I drew a number of semi-circles of diameters regularly decreasing by eighths of an inch, and all having the same lower end with the first one. Applying this frame to the quadrant I was ready to solve the first slide-valve problem which presented itself, namely,

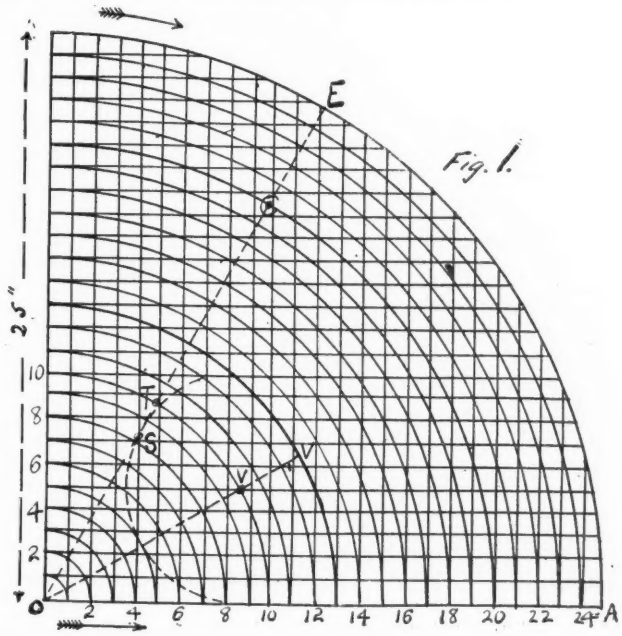


Fig. 1.

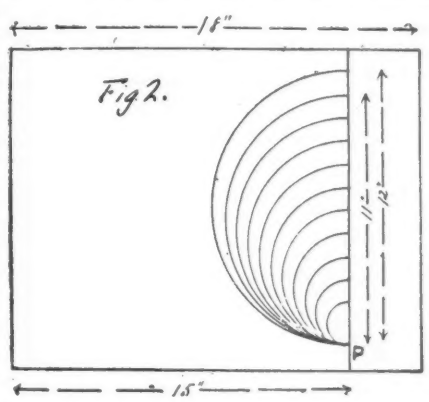
finding the mean point of cut-off with a given valve-travel and steam lap, there being no lead. This linen tracing-cloth I mounted on a slate-frame so that when the frame was lying on top of the cloth, the diameters of the semi-circles would be exactly perpendicular to the frame.

This quadrant, or rather this series of concentric quadrants, is intended to represent the crankpin path during the last half of a single upward stroke of the piston, and also to show one-quarter of the eccentric path. Radial lines drawn from its center to its circumference, or beyond show the line connecting the main center and the crank-pin center. The vertical lines numbered at their foot may represent or measure the inches of piston-stroke beyond the center, for any desired position of the crank The parallel horizontal lines may represent or measure distance of the crank-pin above the center line of a horizontal engine These concentric quadrants may also represent parts of the eccentric-path where there is no rocker-arm (or where there is a rocker-arm with equal arms).

The semi-circles having a common diameter, but arranged thereon, instead of concentrically with one end or edge of each at the same common point, as shown in Fig. 2, may represent or measure inches or fractions of an inch of steam lap on a slide-valve.

We will suppose that we have an engine with 20 inches piston-stroke, and a valve having 5 inches of travel and a lap of 1¼ inches, and that it be required to find where this valve will cut off the steam.

If I wanted to spoil diagram Fig. 1 I would find on the quadrant a horizontal line five inches above the base line O A, this representing a steam lap of 1¼ inches; I should find where this line intersected a quadrant of 2½ inches radius, that being half the valve-travel, or the radius of a circle having a diameter equal to the valve-travel. At this point of intersection (marked V in Fig. 1) I should draw a circle 1¼ inches in diameter, which would of course just touch the base-line O A. I should call this line the lap-circle. I should then draw a straight line from the center O, just touching the lap-circle, and prolong it to the edge of the diagram. The position or direction of this tangent line O E with respect to the base-line O A would represent the crank-position at the time of cut-off with any plain slide-valve having 5 inches travel, steam lap of 1¼ inches, and no preadmission (steam lead). To find at what fractional point in the piston-stroke cut-off would take place, I should follow the vertical line which ran from the outer end of this tangent line O E to the base-line O A. In this case it would be about the line 12, which would show that the piston would have made $\frac{18}{25}$ of the last half stroke at the time expansion commenced. Of course if the engine had 50 inches stroke this would make cut-off at $\frac{87}{50}$ or $\frac{74}{100}$ of the stroke. With an engine of only 20 inches stroke this would make cut-off at $20 \times 0.74 = 14.8$ of the piston-stroke. In fact, if I should consider the quarter-circle that runs through the vertical line marked 10 and drop a vertical line from the point T where the tangent O E cuts the line, I should find that such vertical line would be nearly along side of the vertical line marked 5, which would indicate that the cut-off would be just before the piston had made five inches of this last half stroke of 10 inches.



If I were to run a radius O V through the center of the lap-circle, I should have the angle between O V and O E, which would represent the amount that I should have to set the eccentric ahead of the crank, with the 1¼ inch lap and 5 inches valve-travel, in order for the engine to cut-off at the point indicated without lead. (This is assuming that there was no rock-shaft; but whether there was or not, this would be the so-called angle of advance, or angle to which to set the eccentric).

But instead of spoiling my diagram Fig. 1 by drawing a lap-circle and the radii on it, every time that I wanted to solve a problem, I prefer to place Fig. 2 on it, which represents lap-circles of every desired diameter and may be placed with the center of the desired lap-circle on any desired quarter circle representing the valve-travel. If there be no lead, the lap-circle is to touch O A; if there is to be a lead, it is to be as far above O A (on the scale of the valve-travel and lap) as the desired lead. Thus for a lead of one-eighth inch of valve-travel, the point P, or lower edge of the lap-circle, is to be placed one-eighth inch above O A; and so on.

If there is to be exhaust lap, the exhaust-lap circle is to be drawn about or placed on the point V, wherever that may be, which indicates the center of the steam-lap circle; and radii being drawn or a straight-edge placed so as to just touch the edges of the exhaust-circle, the one just above it will indicate the crank

position when compression commences, and the one just below it the crank position when exhaust release commences. Verticals dropped from the points where these radial lines cut the curve indicating the crank-pin path, will give the point in the stroke at which compression and release take place.

If there is, instead of inside lap or exhaust lap, what is called negative exhaust lap, negative inside lap, inside clearance, or exhaust clearance (all four meaning the same thing), the circle representing the negative inside lap on the same scale as the steam lap is to be drawn in the same way as for the exhaust lap, and the radial lines made in the same way; but instead of the one above this inner circle representing compression and the one below it release, it will be just the other way about; the one above will represent pre-release and the one below will show cushion or compression.

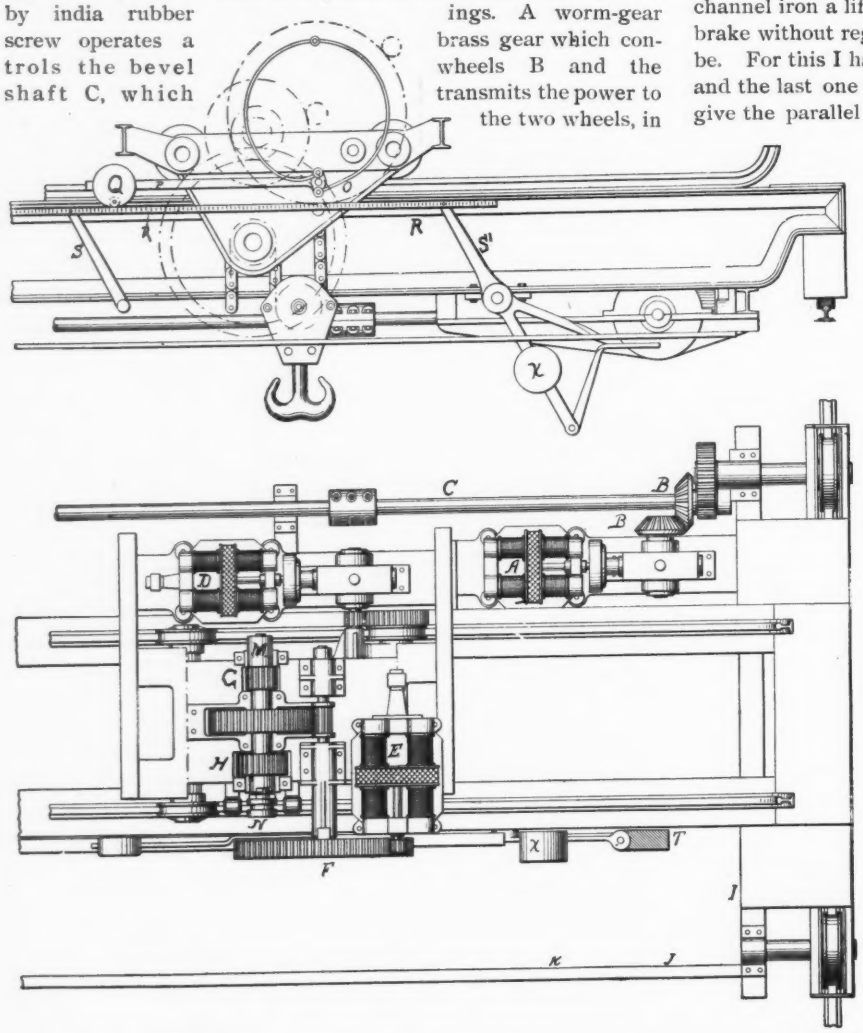
These two diagrams and a straight-edge will enable any one to solve in an instant almost any slide-valve problem.

* * *

AN ELECTRIC TRAVELLING CRANE.

A. Bollinckx.

As will be seen, the crane has three motors, one for each motion, the motors being for continuous current at 110 volts. Motor A is connected to its worm gear by means of an india rubber clutch (Raffard system), which gives an easy starting motion and allows for a small error in the line of the axis of the motor and the worm gear. Raffard's clutch consists of two discs bearing at four points. These four points are connected, two by two, by india rubber screw operates a trols the bevel shaft C, which ings. A worm-gear brass gear which conwheels B and the transmits the power to the two wheels, in



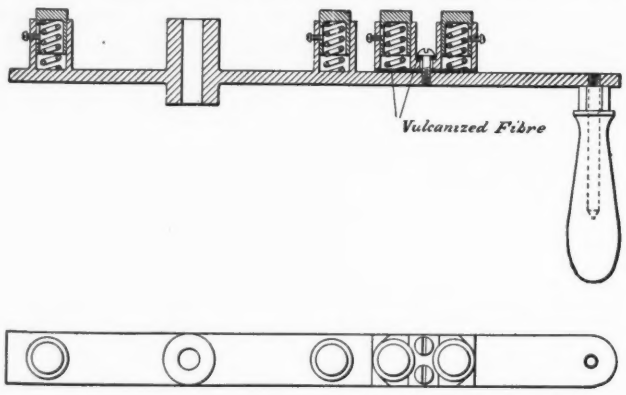
order to get the longitudinal motion of the crane from one end of the foundry to the other.

The worm-gear screw is made of tempered steel and thrusts upon steel anti-friction balls, so as to reduce friction. Motor D operates, in the same way, the transverse carriage of the crane in order to move the load laterally. Motor E operates, by means of a pinion of raw-hide, the large gear F, which carries the brake. This gear F in its turn controls the sundry gears moving the hoisting chain.

We get two hoisting speeds of the load by means of pinions G and H. Indeed, the shaft which passes through them carries two boxes M and N, which throw into gear either one or the other, according to the pushing or drawing of this axle.

The brake is rather interesting, for it is this part which has given me greatest trouble in getting it to operate as easily as possible.

The gear F of which I have spoken is a crown gear. In this crown there is a brake band O lined with pieces of wood. Lever P, which controls it, bears a weight Q in which there is a



small roll to avoid friction. The breadth of this roll deserves attention when the carriage is moving while a load is being let down. The beam R is composed of a channel iron, which runs all along the crane. The problem, therefore, was to give this channel iron a lift parallel to itself to hoist the weight Q of the brake without regard to what point the transverse carriage might be. For this I have made use of the rods S S' every two meters, and the last one S' bears a pedal T on which the man steps to give the parallel lifting motion to the channel iron, and in this way lift the weight Q in order to let the load down. Weight X equalizes the whole, and it is remarkable to see how easily and with what slight effort the whole is operated.

At I is the commutator to operate motor A, at J the one for D, and at K one for E. The driver has consequently all the motions near at hand.

The commutators are made so as to operate the motors in the two directions, and the brushes of the motors are of carbon, which remain after more than two years of use in a perfect state of preservation.

I send you a little detailed sketch of the commutators I have designed, and which have given every satisfaction from the point of view of perfect contact and absence of sparking, which I did not obtain with the contact of the commutators as usually constructed.

* * *

ABOUT DRILLING HOLES.

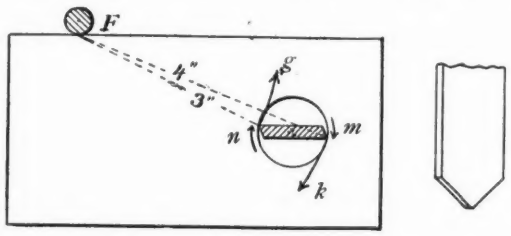
Herman Ritter.

It is a widespread opinion that a boy or a roustabout is good enough to run a drill-press. But as there is almost always something to be learned even in the humblest of occupations, so there is in regard to running a drill-press. To drill a hole that simply looks like one is one thing, and to drill a hole straight and true is sometimes another thing. To commence with the grinding of the drill, there is much sinning done in this respect. How often do we find one lip of the drill a good deal longer than the other one, and in the battle for supremacy that is going on during the drilling operation it is but natural that the longer lip should come out victorious over its shorter neighbor, and the result will be a hole considerably larger than the drill measures. To grind twist drills nicely is quite an accomplishment, and takes some practice. There is one main point not to be neglected in this respect, namely, to give each lip sufficient clearance, that starting from the cutting-edge extends gradually backward and over the entire lip. In other words, the cutting-edge of each lip should stand up higher than

the back part of it. Sometimes you find a twist-drill where this condition is just reversed, and where the back end of the lip stands higher than the cutting-edge. A twist-drill ground in such slovenly manner certainly cannot be expected to work well. This is all of course very simple and plain, but a matter of a little intricate nature connected with the running of a drill-press will be treated in the following.

There are conditions where a hole may have been started perfectly right, but as the drill goes deeper and deeper it runs away to one side without any apparent cause. Of course there is a cause for it, and if known is also easily enough avoided. Such gradual running away of the drill to one side takes place whenever a comparatively large hole is being drilled and the work-piece is not clamped down, but simply held by a pin stuck into one of the holes of the table at a comparatively short distance from the drill.

With reference to the cut, which represents a work-piece, for instance, an iron plate, that a hole is being drilled through; the drill is shown in cross-section and may be supposed to be a common flat drill, while *m* and *n* are its two lips. F is the sectional view of a pin put in one of the holes of the table. The hole may be 1 inch in diameter and the pin F may be comparatively close by, let us say they are only 3 inches apart; it will then be about 3 inches from F to the lip *n*, and about 4 inches from F to lip *m*. Let us see now what forces are acting on the work-piece under such conditions. By letting the drill run in the direction as given by the little arrows, the lip *n* will have the tendency to push the work-piece around as indicated by arrow *g*, with the pin F acting as a fulcrum. On the other hand the lip *m* will have the tendency to push the work-piece around in the opposite direction, as indicated by arrow *k*. If, now, both these forces were equally strong they would have no effect, since one would counteract the other. But the lip *m* is farthest away from the pin F and has, so to speak, a leverage of 4 inches, and it acts therefore more powerful than the lip *n*, which is nearer by the pin F and has only a leverage of 3 inches. Therefore, in the opposing tendencies of the two lips as far as shifting the work-piece is concerned, it is the action of the lip *m* which is a little the stronger of the two, and therefore the result will be a shifting of the work-piece in the direction of the arrow *k*. This shifting will be the greater the harder the drill is worked, and it will cease only after the drill gets so much to one side of the hole that it can go no further. If, however, the pin were quite a distance, let us say 50 inches, from the drill, and assuming again a 1 inch hole, then the two opposing tendencies of both lips *m* and *n* would be nearly alike, because the one would act with a leverage of 50 inches and the other with one of 51 inches, which constitutes comparatively a much smaller difference than the difference between 3 inches and 4 inches. Consequently the work-piece would want to shift about as much in the direction of arrow *g* as in the direction of arrow *k*; hence no shifting at all would take place, but the hole would be drilled through straight.



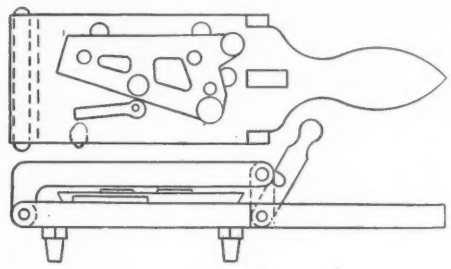
We have taken extreme cases as an illustration, but our investigation teaches the lesson that it is poor policy to stick the pin holding the work piece too close to the drill. In all cases where the work piece is not clamped down to the table, but where it is merely laid on it and held from turning around by a pin, this pin should be as far away from the drill as possible. Where the work piece is by itself, but short, it is advisable to find some kind of extension for it, perhaps a monkey wrench or a wooden clamp, so as to make it possible to increase the distance between the pin and the drill.

* * *

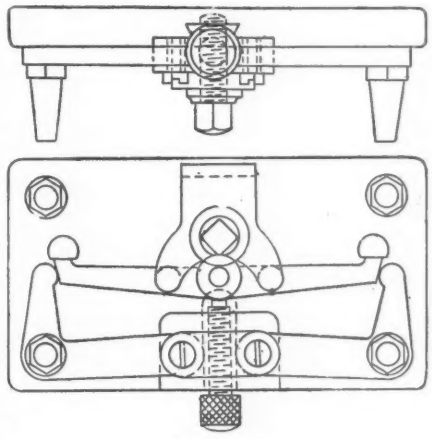
It is interesting to note the statement credited to Prof. Dewar that the tensile strength of iron is twice as great at 400 degrees below zero as at 60 degrees above. This seems to contradict the prevailing belief that iron is more brittle in cold than in warm weather, but careful experiments by Mr. Thomas Andrews of the Wortley Iron Works, Sheffield, England, show a greater endurance to shock when the iron is at a normal heat, the fracture of the cold iron being more crystalline than in the warmer ones.

THREE KINDS OF JIGS.

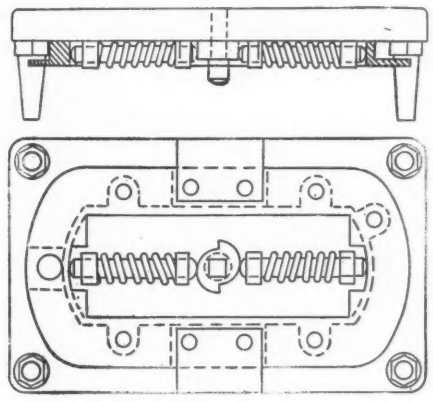
The jigs illustrated herewith, while not entirely novel perhaps, may help give an idea that will aid in developing others suited for the work in hand. Fig. 1 holds the frame by the three studs and the cam with handle attached as shown. The bushings are in the top or hinged portion of jig, which closes down over the work and is locked by the handle shown, the short legs which allow the drill to go through without striking the table being made of studs with a lock-nut to adjust to proper height. Fig. 2 is more complicated, the lower view showing the arrangement of levers for centering the piece to be drilled, in position in the center of the jig. The work is clamped between the flattened pins and the two bell-crank levers, which are pivoted on the lower studs, these bell cranks being regulated by the milled head screw moving the block in the dovetailed guide shown in upper view. The bushings are held in the horns of the bracket shown over the work. Fig. 3 grips the work from the inside as shown in both views, the two bolts being forced out by the double cam at the center, which holds them in the desired position. The springs throw them away from the work as the cam is released, which facilitates handling the work, as each piece is readily released and as easily replaced by another.



JIGS.—FIG. 1.



JIGS.—FIG. 2.



JIGS.—FIG. 3.

* * *

ECONOMICAL MANAGEMENT.

Slow Pay.

I recently noticed a man (in a shop which shall be nameless) drilling 9-16 inch holes in some cast iron flanges ¾ thick; the drill press was new (and painted green*) but the man, in spite of the new green drill press, didn't seem (to my notion) to be getting along very fast, so I began to nose around to see what the matter was, and found that he needed to turn the feed-wheel *fifty* times to drill one hole through the flange, and of course (there being no quick return) *fifty* times more to get the drill out again, making 100 turns of that feed-wheel for each hole, six holes in each flange, and a whole barrel full of flanges.

The man who designed that drill press ought to go into the post-hole business, as "Chordal" would say. I suppose it was bought because it was cheap (and the green paint thrown in). It wouldn't take many such drilling jobs to make up the difference in cost between this drill press and one that had a proper feed to it (say five or six turns of the wheel to drill ¾" deep), and a quick return.

In another place there was a machine carrying a large knife

* Something else green beside me and the drill press in that shop.

which needed to be sent outside to be ground, because the manager couldn't afford a grinder, and which wasn't sent outside to be ground, because it would "Cost so much." Foreman told "master mechanic" he must have the belt tightened, because the knife wouldn't go through the work; "master mechanic" allowed he wouldn't tighten the belt, because the knife was dull, and if belt was tightened something would "bust"; foreman complained to manager, and manager ordered master mechanic to tighten belt; master mechanic tightened belt; foreman started machine.

* * * * Manager asked me how much it would cost to fix the machine, and told me the foreman was a d—— fool. I told manager he better send to the maker and get a new piece. A few days afterward the manager asked me if I didn't think $30.00 was a pretty stiff price for that new piece from the maker.

NOTE.—A machine to grind his knife would cost $90.00.

* * *

COMPOUND TEST INDICATOR.

We present herewith an instrument of special interest to those working on lathes, planers and milling machines, or in erecting and inspecting machinery. It is specially designed for taking easily and quickly the eccentricity of work which needs to run true in any form, and giving greater accuracy than can be obtained by any of the old methods of truing work.

It is not complicated, as shown by the construction (see Fig 1), consisting of a hollow case pivoted to a shank by a split bushing to act as a friction, enabling the workman to place it in any position which the work may necessitate. The indicator may be set to true the work at any angle, and it also enables the tool to swing

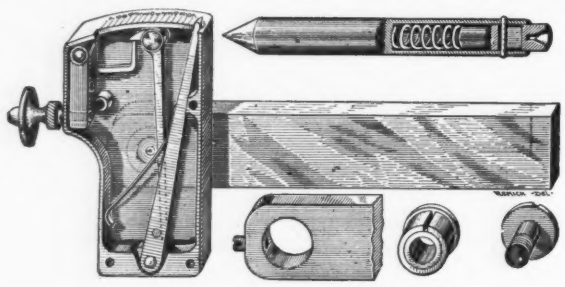


FIG. 1.

back out of range, if for any reason the ecentricity of the piece to be tested should be greater than the capacity of the indicator levers, and thus protects the tool from being injured.

Projecting from the face of the tool is a steel pin so finely adjusted that a movement of $\frac{1}{1000}$ of an inch in either a horizontal or perpendicular direction will cause an indicator point to move across the graduated scale. This indicator is adjusted on a ratio of 83 to 1, in other words, the moving of the pin $\frac{1}{1000}$ of an inch will move the indicator point $\frac{1}{12}$ of an inch on the graduated scale. By changing the pin from a lower adjustment to an upper, this ratio is changed, so that moving the pin $\frac{1}{1000}$ of an inch the indicator will move $\frac{1}{6}$ of an inch.

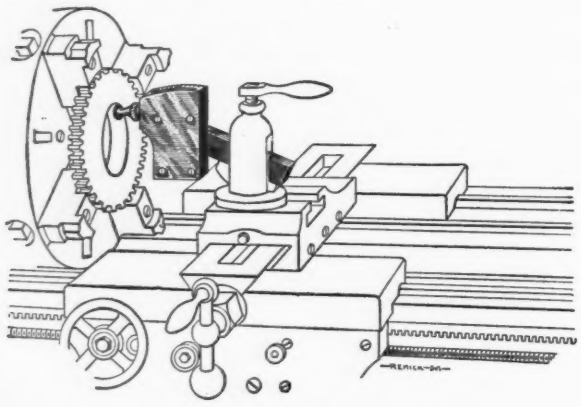


FIG. 2.

These pins are made in several different shapes in order to allow of its ready application to different kinds of work. The scale is graduated to read 14 thousandths of an inch, with zero at the center, and 7 thousandths from zero each way, the pointer moving $\frac{1}{12}$ of an inch for each graduation backwards and forwards. The advantage of having a scale graduated from a center to zero is that it admits of very rapid adjustment, reading being taken from both sides.

Machinists have often found it very trying and slow work to set a piece of work in a chuck, as for instance, a gear where they wish the inside of a hub to be perfectly true, as in Fig. 2. With the indicator it is simply a matter of a few seconds' work, which consists of setting the indicator in a tool-post and running

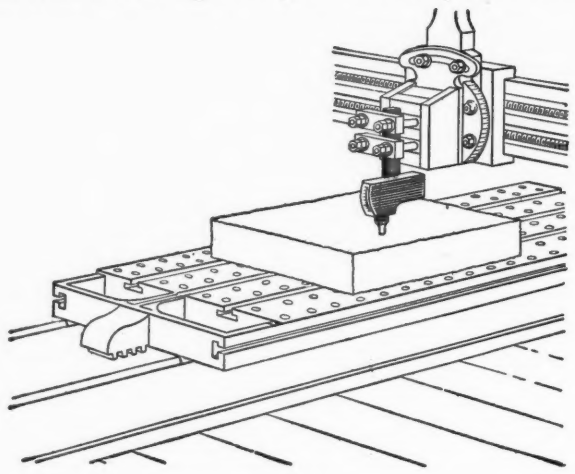


FIG. 3.

it up until the pin projects into the hole in the hub. Now, if the hole is, say $\frac{14}{1000}$ of an inch out of true, by moving the jaw of chuck until the indicator stands at zero, we have the hole true. Then if we wish to true the side of the gear, it may be done without changing the pin, as it is arranged to work both vertically and horizontally.

Fig. 3 shows an easy way of detecting any error of surface on planer, and is especially valuable in testing the platten or setting a cross-bar to a platten of planer.

Further particulars can be had by addressing John Bath, 239 West River street, Hyde Park, Mass.

* * *

WRINKLES ON BLUE AND WHITE PRINTS.*

Having decided on the quality and weight of paper, of which there is a great variety in the market, the paper is next coated in a darkened room. For a solution, the following formula gives good results:

Citrate of Iron and Ammonium ¾ part, by measure,
Water 2½ parts, by measure.

Red Prussiate of Potash ½ parts, by measure.
Water 3¼ parts, by measure.
A glass graduate or any other suitable measure will answer.

The citrate of iron solution may be prepared when sensitizing, and being fresh will give the best results.

The red prussiate of potash solution requires some time to dissolve, and may be put up beforehand as a stock solution. When put up immediately for use, and the red prussiate of potash being in lumps, it is best to reduce it in a mortar. Let the solution stand for twenty minutes and filter through a bit of linen. The solution should be preserved in the dark, and will keep for a considerable time.

The paper, on being coated, is dried in a dark room, preferably warm, and when thoroughly dry is ready for use. The best prints are obtained with freshly sensitized paper, or paper a day or two old, though it is fit for use for weeks, if kept in a dry state and protected from the light.

The chemicals may be had at any wholesale Druggist's or Manufacturing chemist. Four ounces of the sensitizing solution will coat 100 square feet and cost about 6 cents.

Black lines on a practically white ground, gives very good results.

SENSITIZING MIXTURE.

Sesquichloride of Iron	130 grs.
Sulphate of Iron	48 "
Tartaric Acid	48 "
Water	12 drs.
Gum Arabic (thin)	1 dr.

DEVELOPING BATH.

Gallic Acid	15 grs.
Tartaric Acid	3 "
Sulphate of Iron	1 gr.
Water	16 oz.

Developing trays of iron should be avoided.

* *From the Circular of Edward A. Osse, Baltimore, Md.*

"HELP WANTED."

THOMAS PRAY, JR.

The writer does not believe in reminiscences to any great extent, and will therefore address himself directly to the mechanics and engineers who believe some of the things that the writer does. Prominent among these is the fact that a man who is to amount to anything in this world must in the first place have a pretty good constitution, and in the next place he must take good care of his body in order to have a brain that will do good square work, and in the next and not the least important, that man, whoever he is, and wherever he belongs, must not be a regular caller at the bar-room, gin-mill or beer shop. There is another rule of the road, and that is that the man who expects to climb much above the ground floor must really know something about what he is going to undertake. Theory is a very good thing, and the theory of mathematics, or the theory of running a buzz saw, milling machine, planer, or feeding a steam boiler, or attending to a good steam engine, is all right. You *can* learn something out of books, but if you are going to be a machinist you will naturally have to take off your kid gloves and commence to chip castings after you have first learned to clean off the sand and the pickle scale. Even then you do not quite know it quite all. It takes as much as an hour to learn how to grind a tool, and if you have not one of Seller's grinders you may spoil more tool steel than your own head is worth, in learning how to grind a tool that will cut cast iron which is a little mottled.

If you are going to learn something about a steam engine, the time would not be lost to go into a drafting room of an engine shop and study the detail of construction, follow through the pattern room, and then get down on the moulding floor, even if you do get sand on your patent-leather shoes, or a little dust on your new cravat. Then if you will, go out in the back yard and help Bill sort out the different kinds of pig and "make up his mix for the blow." Get a few ashes into your hair, smell the coal gas, and if your shirt should get moist with good, honest perspiration when you go down on the pouring floor, or get a splash now and then from the ladle. If you see a few blisters come up on a casting that you have broken your back over for a day or two while it was in the flask, and then go home so tired you cannot sleep for the back-ache, you will begin to be of some use to the man you are going to work for.

The royal road to learning was blocked up a great many years ago by a thick wall; the wind has blown it full of dust, and the last we heard of it the grass was growing over it all.

There are other reasons connected with the giving of aid which makes it difficult for an editor, foreman or others who are in charge, to whom such appeals are often made, and that is unreliability of so much that is printed, simply to fill space, or to ventilate some idea, or leaning toward some machine or apparatus. So that in this case any one who is looking for information must learn that the information accorded must be capable of proof or a demonstration which is beyond doubt. This being learned, it then becomes easy to advise those who have not had the experience or practice, or, so many cases, the opportunity to benefit themselves by actual contact with the various problems which are presented to an engineer in active practice, more especially when that practice includes important matters or what may properly be referred to as matters of great importance in their line.

One of the most important things that a young man or any one who is seeking to benefit himself, is to give attention to being accurate. Prove any problem presented before making any use of it in important computations; some of the curious instances of the lack of this important element in text books which are very largely used, recently came to the writer's notice, one case in particular, to which I shall here refer. A few months since some computations which included the areas of some large pistons were presented on both sides in court. Some thousands of dollars were at issue, and when properly allowed in the trial of the case, the items were so materially different as between the two sides that the judge asked why men computing the same data could not come nearer to the same result. The reports were all sent to the writer by the court, with instructions to make clear the differences of both parties, and both parties were asked to furnish their data. Both had honestly done their work and yet their work showed material differences in the result. A computation over this was taken from the best known authority and some of the most curious results came from that computation, which will undoubtedly interest the readers of MACHINERY, whether they are in the engine room, machine shop or elsewhere. The reason of the difference in their computations was, primarily, that they had used two different sources in the area of their pistons. A computation by the writer in both books showed an error of 20 inches in one area and other errors running to the second place of decimals. When both were corrected there was no difference, and one of these same errors was lately discovered by my friend Dr. Coleman Sellers, in checking some other computations. The book referred to has been on the market several years, and has been considered reliable. A further computation of one of its pages very lately shows twenty-four errors in one column on one page. The publishers of the book were advised by the writer, since which time another edition has been printed, and it is the latest edition in which Dr. Sellers discovered the error.

The Greek letter π which represents the ratio of the diameter of a circle to its circumference, has been the source of a great deal of trouble to mathematicians, and has lately been rediscussed with a view of the adoption of a new constant. A Swedish mathematician has recently attempted to say that the exact ratio of π is $3.\frac{45}{289}$, or as 912. is to 289. so is π to the circumference of the circle.

If any of the readers of MACHINERY figure this out as the writer has done, to fifty-two places of decimals, they will find that it is just as interminable as the old number which is given by Vega's ten-place table of logarithms, printed in 1794, to 155 decimal places.

By carefully studying your starting point, getting that correct, and then being equally careful of the progress which you make, proving at every possibility your position by reference or comparison, and by doing this you are pretty sure to have seen the advantage of it. The ordinary commercial affairs of life do not require the use of ten-place decimals, but it is necessary sometimes to compute very carefully what a man's prior training may have been, and what influence it will have upon the work he is going to do, in any trust with which he is to be connected. And it is little things far exceeding ten-place decimals in their influence on the total that send a man to the head of the class in the important affairs of life, or relegate him to the place which the boy occupied, when there was only one fellow ahead of him, there being two in the class.

If a young man starts as nearly correct as possible and proves his position day by day, or month by month, he is perhaps more careful in giving out his results, for he knows how small a variation stands between being accurate and making a mistake. The man who learns to discuss these questions for himself from the basis of pure mathematical reasoning and demonstration, will be pretty sure not to have time to hang around the club room or saloon, and he will be certainly qualifying himself to give an opinion which, when given, will carry with it all the force of good reasoning, and, as Rankin so happily expressed it, "closely approximate" in its value, and just that much more important in its use in the affairs of life, where men turn labor, material, time and effort into money.

A man should no more trust any set of tables in the world outside of perhaps two or three old editions of logarithmic tables, than he should trust the opinion of his fellow workman on financial, commercial, social or other matters.

The writer has several times expressed it in his lectures that there was such a thing as knowing too much that "ain't so," and the surest way to know whether it is so or not is to qualify yourself to compute any quantities with which you are to deal, without having to look at a table, or a book of logorithms. Then you can vastly facilitate matters by the use of a table of logarithms.

The properties of material is another branch of the business, and this should be thoroughly learned, and every machinist should study the chemistry of iron and steel, from any of the books which are to be had for a moderate price; they should know something of testing, specific gravity and specific heat as the surest way to prevent mistake which so often occur in the misapplication of materials.

Steam engineers should know the properties of fuel, the best chemical combinations, the elements of heat in such combinations; they should learn the physical properties of water, under pressure or otherwise. All this can be learned from elementary books, which are cheap and reliable, and any man who will take an hour a day careful study, can in six months master either one of these subjects mentioned. This way of spending time pays vastly greater interest than many other uses to which it might be put. And this is only the beginning for the man who commences

on any subject of this sort that has the real sand in him, and will surely creep up another rung of the ladder as he does the first one, and to some extent masters it.

Most men who work for their living endeavor to do honest service, and we very frequently hear them complain that some other fellow has got promotion. The man who merits promotion by reason of his knowledge and then attends to his business, is usually more sought after than the one who is constantly getting a raise in his job, and the man who does this work earnestly is very seldom found on the street looking for work. This may be considered a pretty strong statement, but for almost twenty-nine years of my own professional life it is safe to say that the statement is far inside of the fact. There are more capitalists to-day looking for capable men than there are men looking for jobs, that is, men who can properly be spelled with a capital M. What this will lead to in the next ten years it may or may not be my province to see, but many changes are going on in our own and in other nations.

* * *

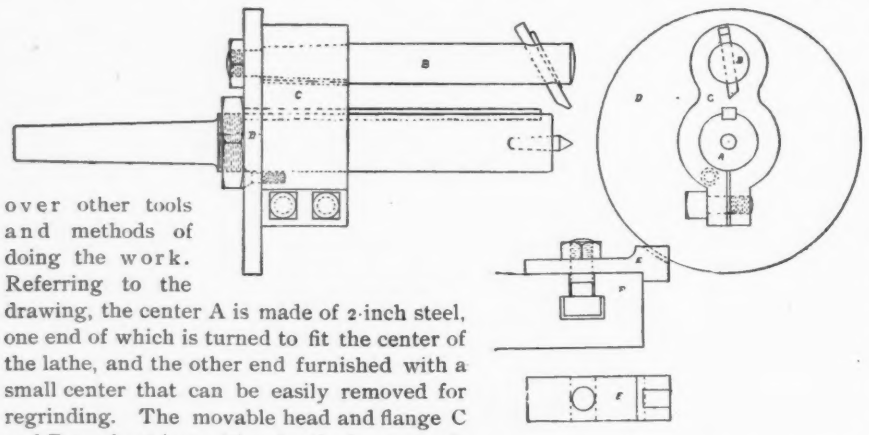
WHAT MECHANICS THINK.

THIS COLUMN IS OPEN FOR THE EXPRESSION OF PRACTICAL IDEAS OF INTEREST, TECHNICAL OR OTHERWISE. WRITE ON ONE SIDE OF THE PAPER ONLY, AND BOIL IT DOWN.

WHEN SKETCHES ARE NECESSARY TO ILLUSTRATE THE IDEA, SEND THEM ALONG—NO MATTER HOW ROUGH THEY MAY BE, WE WILL SEE THAT THEY ARE PROPERLY REPRODUCED.

SPECIAL SHOP TOOLS.

Many machine shops, and especially those owned by railroad corporations, have equipments that were considered first-class ten or twenty years ago, but to-day are so far behind the improved tools now manufactured as to call for considerable ingenuity on the part of the mechanic in order to turn out the work in good time and finish. To such, a description of the special tools designed from time to time by fellow workers to help meet some emergency are interesting. While employed as foreman by a certain railroad company the general foreman brought in a set of air-brake levers with 3½ inch pins at right angles with a 3-foot arm, such as is used on American outside equalized pressure brake for locomotive drivers. The pins were to be trued up and bushed, and as we had no lathe large enough to swing them I was ordered to have the smith cut the arms, and after turning to re-weld them. With a view to avoid all that extra work, and having at the same time several tumbling shafts to be turned up, I designed the tool as shown, which we found to do the work quickly and satisfactorily and to be an improvement

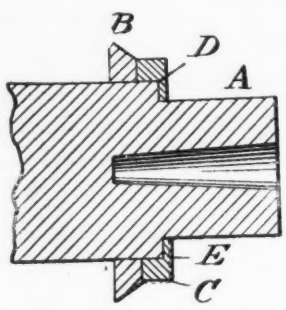


over other tools and methods of doing the work. Referring to the drawing, the center A is made of 2-inch steel, one end of which is turned to fit the center of the lathe, and the other end furnished with a small center that can be easily removed for regrinding. The movable head and flange C and D are kept in position by the key extending to the end of the center. This key should be a perfect fit, so as to keep the head C steady. The arm B should be 1½ inch steel, carrying near the end a tool, round or square; if round it should have one flat side, so as to be secure by the key; or a set-screw may be used if preferred. The arm B should be movable, so that should a longer arm be required it can easily be changed. The flange D is used to feed the tool to its work, by means of a small plate secured to the slide-rest and notched, as shown, to receive the edge of the flange. By this arrangement the tool can be used on fine or coarse feed, or in fact, in an emergency, to cut thread, as its change of feed is only limited by the capacity of the lathe itself. Of course, if any amount of thread-cutting were required to be done with this tool, some quicker means of adjustment of the cutter would be necessary. In that event it would be advisable to have the thread tool secured with a set-screw placed parallel to one of its sides with a collar large enough to force the tool down from the top, the tool reaching to the under side of the set-screw, then tighten up with the set-screw on the side. There are of course other means of securing this adjustment, but I think this would be the cheapest and do the work satisfactorily.

Reading, Pa. F. M. ARTHUR.

FIXING A COLLAR ON THE LATHE SPINDLE.

I am at present running a 30-inch lathe built by a reputable firm; but for some reasons best known to themselves they do not put a collar on the spindle outside of the boxes. The consequence is there is not shoulder enough to support the chuck and face-plate. (A) shows end of spindle (thread not shown) 3½ inch diameter, the journal is 4½ inches diameter, which leaves ½-inch shoulder. My lathe has a 30-inch Westcott chuck, which is very heavy. Added to the weight of the chuck would sometimes be the back head for a 20-inch locomotive cylinder; this weight made the lathe chatter. To get more back support I bored out a steel ring C, with a shrink fit on end of spindle, and a slip fit over thread; counter-bored the ring, so it would touch the shoulder D of spindle and face of boxes at the same time. I heated the ring, slipped it on spindle and screwed small face-plate up against it tight until cool. The ring shrunk away from the brass about the thickness of paper. Then turned outside down to size of boss on brass and faced down to ⅛ inch at E. It made a good solid job and was quite an improvement to the lathe.

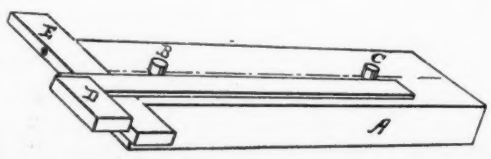


MR. CHAS. E. BILLINGS, in the May number, quotes some experiences with Enfield rifles. The writer was one of the crew of the U. S. S. *New Ironsides*. We had one hundred of these rifles on board. The nipples of all of them were too large for the United States regulation caps. Having a grindstone in the engine-room I was elected to grind one hundred British nipples down to a standard size. The grindstone was belted to a large pulley, turned with cranks and by hand. When any of the men on deck required some light punishment they were sent to the engine-room to turn the grindstone; and during the process of grinding I had to hold the nipples in my fingers. Yes, I know we could have fixed a holder for them if we had been fixed to do it, but as it was I got through before the war was over.

Indianapolis, Ind. W. DE SANNO.

METHOD OF SQUARING A TRY-SQUARE.

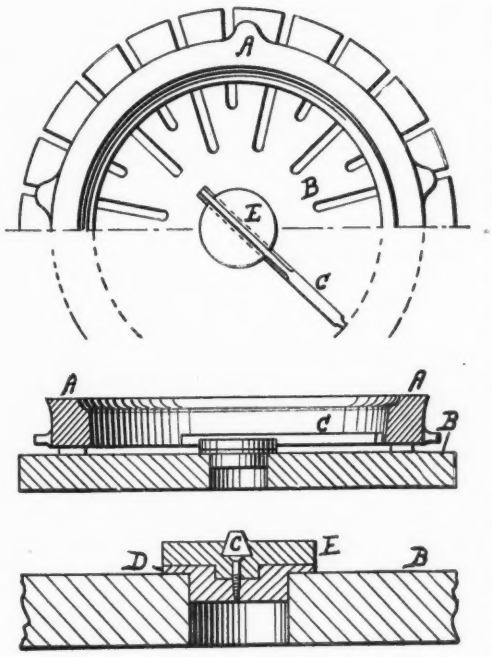
A flat piece of cast iron (A) about 12 by 39 inches was carefully planed up and a central line put on it lengthwise; three staight-edges were then scraped together in the usual manner and one of them E was screwed fast to the end of the plate A; this end was also scraped to the straight-edge E and the straight-edge "tried for straight" on its outer edge after being screwed on the plate A. Two hardened steel rolls B and C were then made and ground true on the sides and square on one end. These rolls were bored for bolts which fitted loosely, so that the rolls could seat themselves on the squared ends against the plate A. Two holes were then drilled through plate A, at B and C on the central line; these points were as far apart as the blade of the square D would permit. The roll B was then bolted down securely and the blade of the square D brought against it while the head was against the straight-edge E. The roll C was then adjusted against the other end of the blade so that the blade just held tissue paper at each end against the rolls. The rolls B C were then tried "for square" with plate A, and the square D was reversed, *i. e.*, was turned over, and the same side of the square E was brought against the other side of the rolls B C, while the head was still on the straight-edge E. The *same* part of the *same* tissue paper was then tried between the blade and



the rolls B C, the difference between the distance of the blade from the roll it *did* touch and that which it did *not* touch being of course twice the amount the square was out. The distant roll was then adjusted to half the difference and the blade was brought to it by grinding, after which it was carefully tried on *both* sides of the rolls as before. This was continued until the blade showed the same on *both* sides. The edge of the blade and the edge of the head were finally tested with a straight-edge to be sure they had retained their perfect rectilinearity. It was necessary to put a block *under* the head in order to keep the blade parallel and in line with the top of the plate A, so that it rested on the plate A throughout its length and was not affected by the weight of the head at any time. The square D had a 36-inch long blade and was of the usual thin blade and thick head type. We do not claim this to be an absolutely accurate method, but it is one which any shop can carry out without any great cost, at the same time giving *practically* accurate results. "TRI-SQUARE."

CENTERING CAR-WHEEL CHILLS.

One of the handiest wrinkles I know of for centering car-wheel chills, or other similar work, is shown in the accompanying sketch. Let A be the chill or ring to be turned, B the table of boring mill, C movable wooden pointer, D stationary head fixed in B, E head which revolves in D and carries pointer G, which is held fairly tight by friction to retain its place as the operator moves it around the work. Little explanation is necessary, as any good mechanic can readily see how it is used, the pointer showing the truth of the centering of the work as it is revolved inside of it. I have re-centered chills more accurately and in half the time that it can be done with chalk, having the work revolving. JOHN H. BECKMANN.



Louisville, Ky.

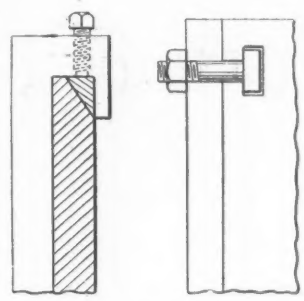
A PLANER TOOL.

The sketch represents a planer tool which I made, the first one I ever saw, some ten years ago, and have never seen many in use, although it is one of the handiest tools in the shop. You can spline pulleys and gears with it and adjust the bar to the length of the hub and avoid the spring; you can spline opposite sides of the hole or at right angles with it, without moving the work after you have once set it; you can recess out work, chamber work, where you could not without several special tools, and then it makes a splendid advance tool for planing work which will not go between the uprights of your planer; in short, you cannot afford to be without it. Make a forging as large as you can get in your tool-post, with head same as in sketch, plane up part which goes into your tool-post, bore out head and ream 1¾ inch. Drill counter-bore and tap for two binding screws in bottom, then saw open and fit a bar 24 inches long, with one end turned down to 1 inch and back about 7 inches, for splining small work. Drill two holes in bar about 1¼ inches from the end, ¾ inch in the large end and $\frac{5}{16}$ inch in the small end, then drill and tap for ½ and ¼ inch set-screws. Make your tools out of round steel. When using tool in planer or shaper put a small planer jack behind top of tool, so that the tool cannot raise off the work when it strikes it. I have a wedge that I use to hold the apron down with, but I now have drilled and tapped a hole in the bottom of the swivel, just counter-drilling enough with point of drill so that the set-screw will hold the apron down, and I find it much better. B. F. GROUT.

St. Johnsbury, Vt.

TWO METHODS OF CLAMPING.

The two cuts with this will show the difference between good method and one not so good, for clamping one part of a machine to the other. The left-hand sketch shows a method often used for this work, consisting of a wedge-shaped gib, held to place by the set-screw shown. The defect is that any straining on the set-screw tends to "hump" the slide, while if made as shown at the right, with the T headed bolt, the slide is clamped solidly and is less liable to spring than the other. In addition to this it is cheaper to make, as the slot can be milled at one cut, and there are no fitting of gibs as in the first case, besides giving better service F. W. LEGRAND.



CONCERNING CHISELS.

I think your writer missed his point regarding chisels, as shown in the May issue. I have never seen chisels made in the way he mentions, unless for stone-cutters' work. Chipping chisels are usually dressed thin to save dressing often, but they are never ground like wedges in my experience. The sketch shows a standard form for flat chipping chisels when men used them to dress surfaces straight and true. The angle of cutting edge should be longer on one side than on the other, to hold the chip. E. P. W.

THINKS HE'LL BECOME AN "EDITTUR."

MISTER EDITTUR— I went into a masheen shop the other da, and sorn a boy cutting skruez with a hand dy stox: u no i mak bolt cutters, and i sez to the boss mister Why don't U by 1 ov my bolt cutters, and the boss, sez he, cos I hev gotter hev sumthink for the boys 2 du. Yurs till deth, constunt reader. p. s. the bolt cutter biz don't reseev the inkuragement that sum other biz duz. ges I wil go intu the traid paper publishin biz.

THAT THUMP AGAIN.

Although it is not my wish to enter into any controversy with Mr. Clarke, yet in order that others may not be led astray by his criticism, I would like to state several reasons why a taper-piece in the bottom of that key-way in particular, or in fact most any key-way, is not just as good.

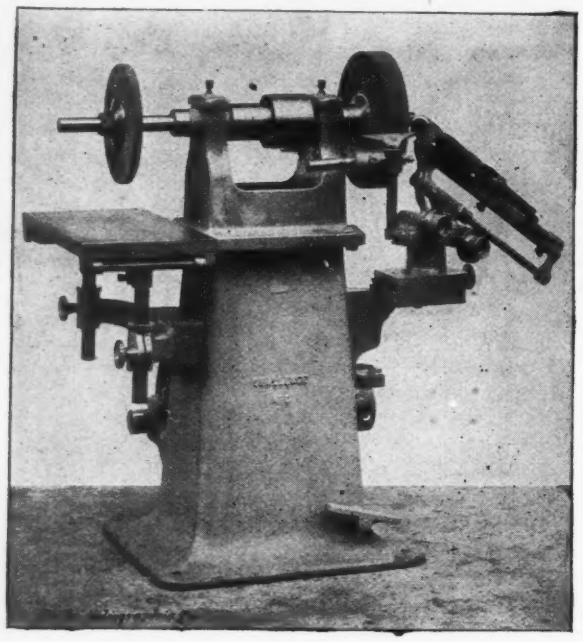
First: We all admit that a key-way rightly proportioned in the shaft, is better than just a flat, planed or filed on one the shaft. Therefore, depth of key-way in shaft must certainly be of some consequence. To put a taper-piece in that would stand driving a key over it without buckling would have made the key-way too shallow. It is a much discussed question whether a key should fit sideways, and, leaving out formulæ and tables for key-way, it is my opinion that a key should fill sideways and have a good, deep seat, for the reason that if it ever does work loose there is not so much danger of having the key seat widened and spoiled as there would be with a shallow seat.

Second: In driving out the old key it tore the key and key-way in hub badly, for right in the center of hub was a cold shot that had, I suppose, been at one time partially fused to hub, and when the key was loose and pounding had broken out; anyway it turned and wedged the key so tightly that we almost despaired of ever getting it out. In that case something had to be done.

Third: I admit that I did not think of Mr. Clarke's way partly because I had to drift it out and also because it was not the right way, I suppose. WM. M. FRANCIS.

COMBINED TWIST DRILL AND SURFACE GRINDER.

The Appleton Mfg. Co., 29th and Thompson streets, Philadelphia, Pa., has recently added the combined twist drill and surface grinder shown in the accompanying illustration, to its line of manufactures. The twist drill grinding feature is designed to enable any one to grind drills from the smallest size up to three inches in diameter, in the best possible manner, very rapidly and without skill being required. It is furnished separately or with surfacing arrangement, as shown. When furnished as a twist drill grinder only, a plain rest is also provided for the other wheel, for general dry grinding or for odd jobs. In operation, the drill is dropped in place and the two upper graduating hand-wheels turned to figures on the dials corresponding with the diameter of the drill.



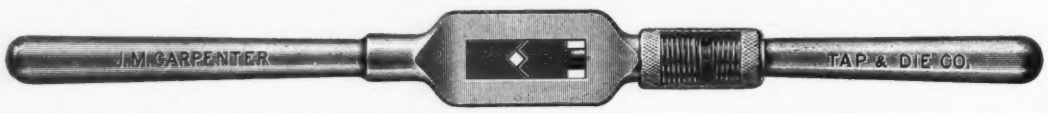
These distances being the standard for angle and clearance, to insure the greatest efficiency with least wear and danger of breaking the drill, there is no skill required to operate it. The drill and drill-holder are then grasped and rotated, thus grinding one lip. It is then turned over and the other lip is ground in the same manner, the lower hand-wheel being used to advance the drill-holder towards the emery-wheel.

The surfacing arrangement is designed to pass the work under the emery-wheel by hand, or a compound slide may secured to the table and the work fed in that manner. The table has a fine vertical movement by hand-screw, and a wide range in heighth and width, while in length of piece there is practically no limit. The machine is made in three sizes, and may be had as a surface grinder only, or as a surface grinder and twist drill grinder, as shown.—Adv.

* * *

NEW TAP AND REAMER WRENCH.

This wrench is entirely different from any other, as no pin, wire or other implement is needed to tighten its jaws upon the tap or reamer, the hand alone being sufficient to tighten the jaws so firmly that there is no loosening of its grip while tapping or reaming. The knurled sleeve contains a right-hand thread on the outside of the neck of the stock and a left-hand thread on the handle, the two being embraced by the corresponding interior threads of the sleeve, a right-hand turn of the sleeve closing the jaws and a left hand turn opening them; and the handle moving without any rotary motion avoids all tendency to unscrew while at work. The large diameters on which the threads can be cut in this



design, allow of using threads coarse enough to produce quick movements of the jaw, while the angle of the threads is so small that sufficient power is obtained by the hand alone to get a strong enough grip to prevent all loosening while at work.

This is believed to be the only Tap and Reamer Wrench that can be so firmly tightened by the hand that it will not loosen while being used.

It is well made, has hardened steel jaws, all the parts are made interchangeable, while the weakest point in all similar wrenches is in this one greatly strengthened by the knurled sleeve.

They are made in five sizes, taking taps from 0 to 1½ inches diameter.

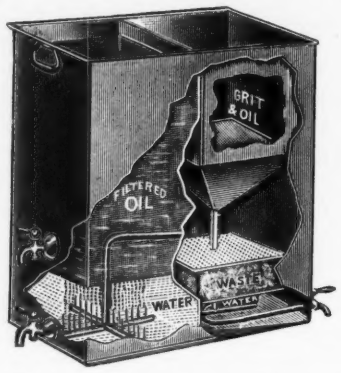
Manufactured only by The J. M. Carpenter Tap and Die Co., 17 Newall Ave., Pawtucket. R. I.—Adv.

* * *

THE FINLEY OIL FILTER.

A reliable oil filter is coming to be considered as a necessary part of almost every kind of a mechanical plant, from the small machine shop to the large power plant, saving from 50 to 75 per cent. of the oil bills in many cases. To be of the greatest value it must so thoroughly clean the oil that, after being used over several times it shall be as free from grit and discoloration as before using. This quality, together with a simple construction, is claimed by the Finley Oil Filter, made in two sizes by the Genor Bros., 99 Washington street, Buffalo, N. Y.

Referring to the cut, the uncleaned oil is put in top of first chamber at the right, over the strainer, which is readily removable for cleaning. The oil passes down through brass tube to settling chamber, where sediment has a chance to settle before rising up through water and filtering bed, and can be easily drawn off through faucet provided for same at bottom of chamber, which is a great advantage, as it keeps filtering material free from clogging and the oil is not passing through sediment it has previously taken out, as is the case when oil passes down through filtering materials.



After the oil settles it rises up through water and filtering material and over top of same and passes down through tubes into secondary chamber, where it is washed and ready for use. The filter requires but very little attention, except to draw off sediment at the lower faucets once a week, and once in six to eight months to draw off oil in primary chamber, saving it to filter over. After drawing off oil lower faucet is left open and hot water run in the stationary funnel on side of tank, which runs over top of filtering bed and down through the same, washing off the bottom of bed and settling chamber, making it unnecessary to take it apart, which can be done very easily if necessary for inspection, by lifting the whole filtering bed-plate and tubes out of tank.—Adv.

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MANUFACTURING NOTES.

The Watts Steam Regulator Co. have recently succeeded the late Mr. Jos. E. Watts, of Lawrence, Mass., and will carry on his business, making a specialty of the Watts Pressure Regulator. The new firm consists of M. F. Pickels and Mr. D. W. Dodson, who bring both energy and experience into the business.

The Garry Iron and and Steel Roofing Co., of Cleveland, has just received an order for several cars of heavy corrugated and curved iron.

The Union Brass and Metal Mfg. Co., of St. Paul, send us their latest list, which comprises a full line of plumbers' supplies.

We learn that the Nicholson File Co., of Providence, R. I., whose output is more than 50 per cent. of the entire file product of this country, have caused to be posted in their three factories, two at Providence, R. I., and one at Pawtucket, R. I., notices announcing a material advance in wages paid their employees. This increase will affect upwards of 1,000 hands, and on the part of this company was a purely voluntary act.

Mr. Oluf Tyberg, M. E., long and favorably known as a practical and theoretical engineer and as the designer of many automatic and other labor-saving machines, has recently acquired an interest in The Brady Mfg. Co., and accepted the position of superintendent of said concern, succeeding Mr. Wm. H. Pike, Jr., who resigned owing to poor health. Mr. Tyberg is at the factory at 83 Washington street, Brooklyn, where he will be pleased to serve his friends and patrons.

The president of the Water and Lighting Department of Harrisburg, Pa. says: "I have long ago forbidden the use of white or red lead or anything but your graphite compound in this department. The result is that we have no more breaking of bolts or nuts on our street mains, valves, etc., or any trouble of that kind in or about our pumping plant. I think those plumbers or steam fitters who persist in the use of white or red lead are doing so purely through ignorance, as nothing is so costly, not even carelessness." This graphite pipe-joint compound is manufactured by the Joseph Dixon Crucible Co., Jersey City, N. J.

The Builders' Iron Foundry, Providence, R. I., have embarked in a new line of work, namely, grinding and polishing machinery, with a view of making a special feature of this work. This department is to be looked after by Mr. Wm. C. Buell, and will include a full line of high-speed wooden buffing-wheels. A booklet and circular tells all about it.

FRESH FROM THE PRESS.

Thomas Carlin's Sons, Allegheny, Pa., send us their new catalog showing in its 220 pages the various contractors' tools made and handled by them. Boilers, hoisting and ventilating engines, road rollers and scrapers, dumping cars, bar shears, bending rolls and portable engines are among the many tools mentioned. Almost everything in the way of supplies and equipment for contractors seems to be shown, or can be obtained of the firm named.

The absolute comfort of the passenger service of the New York Central is attested by thousands of experienced travelers.

The new catalog of the New York Belting and Packing Co., Ltd., 18 Park Row, New York, contains about 100 pages, well printed and illustrated. It devotes considerable space to belting, gives good advice regarding its use, and rules for calculating power transmitted. Hose, packing and matting are also liberally treated, and the new interlocking tiling is shown in an attractive and interesting manner. This is especially attractive on account of its freedom from noise, so annoying in ordinary tiling, and the ease with which it can be renewed when worn. Vulcanite emery wheels also receive attention, and the various sizes and grades are mentioned with good advice regarding them, and taken as a whole it will be interesting to any mechanic or superintendent.

Two to Fifteen Days' Pleasure Tours: No. 8 of the "4-Track Series." This describes a series of tours occupying from two to fifteen days, arranged for the purpose of meeting the wishes of all classes of travelers, including trips to the Thousand Islands, Montreal, Saratoga, Lake George, the Catskill Mountains, Niagara Falls, Chautauqua, Adirondack Mountains, Berkshire Hills, Richfield Springs and many other famous resorts. Information concerning these trips is given—distances, time, fares, connections and all other details—with much precision. It will be sent free, post paid, to any address on receipt of two 2-cent stamps, by George H. Daniels, G. P. A., N. Y. C. & H. R. R. R., Grand Central Station, New York.

One correspondent has a glove fastener which he wishes made in large quantities. They are of sheet brass and must be made with precision. Another is looking for a machine for making hat-blocks. Makers of these articles should address this office.

THEO. ALTENADER & SONS, Philadelphia, Pa., makers of the well known "Altenader" drawing instruments, send us their latest catalog of 110 pages, standard size, nicely bound and containing much to interest draftsmen. Their new spring joint pen is shown, and the page showing the effect of corrosion on pens illustrates the advantage of a pen that can be easily cleaned. It will be sent for four cents in stamps.

ELECTRICAL ENGINEERS' AND STUDENTS' CHART AND HAND BOOK of the Brush Arc Light System. H. C. Reagan, Jr. Norman W. Henley & Co., New York. $1.00. This is written especially for those who use or are interested in this well known system of lighting. The peculiar winding of the Brush machine makes it appear complicated. But this book and chart will make it clear to any one who will carefully study it. The chart is quite a novelty, being of card-board, with the machine and circuits in outline, while the armature and brushes are of celluloid. The armature can be revolved, showing different paths for the current at different points, and is a novel and instructive addition to the work. The contents having been passed on by a representative of the Brush Co., any statements found therein can be accepted as correct.

THE LODGE & DAVIS MACHINE TOOL CO., of Cincinnati, Ohio, U. S. A., have just issued a large handsome poster printed in four languages, English, French, Spanish and German, illustrating their various lines of engine lathes. milling machines, planers, drill presses, shapers, screw machines, etc. This poster will be mailed to any address upon application.

THE WATERBURY FARREL FOUNDRY & MACHINE CO., Waterbury, Conn., are issuing a series of small circulars of new machinery, in a very handy form for ready reference, as they can be easily inserted in their general catalog. These will be sent to those interested in special machinery on receipt of application, and the collection is sure to be an interesting one.

THE SHEFFIELD CAR CO., Three Rivers, Mich., have issued a special foreign edition of their catalog of light cars, in four languages, English, French, German and Spanish being represented. It illustrates their product in the line of hand-cars, railroad velocipedes, railroad standpipes, etc. It will be sent to any part of the world on application.

TRUTHS is the latest literary production of the Hogan Boiler Co., Middletown, N. Y., and seems to have been instigated by FACTS, of the Babcock & Wilcox Co., mentioned last month. The advantages of the Hogan boiler are set forth and the other side of the question presented in a very forcible manner. Those nterested in boilers will do well to study both books and draw their own conclusions.

THE BOSTON BELTING CO. have just issued two small catalogs, M. C. B. standard, one a "railroad edition,' the other for ordinary mortals, describing the various kinds of goods made by them. Belting, hose of all kind, packing, valves, springs, diaphragms, mallets, mats, etc., etc., are shown and prices given.

THE SULZER-VOGT Machine Co., Louisville Machine Co., Louisville, Ky., are pushing their electric elevators, and have just issued a catalog showing its advantages over those driven by steam or hydraulic power.

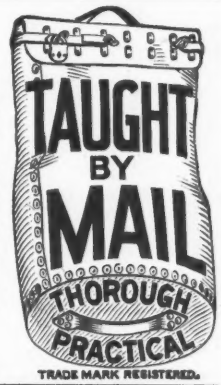
From The Engineering Magazine June 1895

NEW TRADE CATALOGUES.

The Meriden Machine Tool Co., Meriden, Conn., U. S. A =(1) Illustrated catalogue and price list, 1895. 32 pp., 6"×9". [Five pages are left blank, except that the title of the company and the word "Notes" are printed at the top. Describes a line of machine tools, particularly lathes and lathe appliances, turret lathes, self-oiling counter shafts, drill presses, universal joints, etc., manufactured by this company.] (2) Pamphlet, 6"×3⅜", entitled "Selections from the Poets (and others), with comments." [This is one of the most unique bits of trade literature that has come under our notice. The name of the firm which perpetrates this pleasant joke appears nowhere except on the very last page, whereon is written the sentence; "The perpetrator hopes to be forgiven; an order for (or even an inquiry regarding) a forming lathe will be accepted as evidence of forgiveness." The signature of the firm is appended to this plea.]

The author of the above described "unique bit of trade literature" will accept engagements for similar work: address. Walter Lee Cheney, Box 702 Meriden, Conn.

MECHANICS



Mechanical Drawing; Electricity; Architecture; Architectural Drawing and Designing; Masonry; Carpentry and Joinery; Ornamental and Structural Iron Work; Steam Engineering (Stationary, Locomotive or Marine); Railroad Engineering; Bridge Engineering; Municipal Engineering; Plumbing and Heating; Mining; Prospecting; the English Branches.

The courses commence with addition in Arithmetic, so that to enroll it is only necessary to know how to read and write. A Scholarship entitles the holder to tuition, until he is qualified to receive the Diploma, no matter how long it may take nor how often it may be necessary to review. Students can interrupt their studies and change their residences. Scholarships are not forfeited upon failure to pay installments promptly. Each student is a class by himself, and has the advantage of individual direction by a competent instructor. Students make rapid progress in learning to Draw and Letter. Specially prepared Instruction and Question Papers, Condensed, Simplified. The Steam Engineering course is intended to qualify engineers to secure Licenses. All representations may be relied upon.

Send for Free Circular, stating the subject you wish to study, to

The International CorrespondenceSchools, SCRANTON, PA.

An A 1 experienced Mechanical Draughtsman and writer of technical articles desires a permanent position. General work.

Refers to Editor of this paper.

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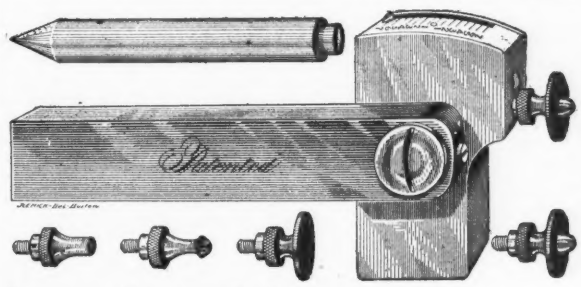

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for producing perfect machine work quickly and easily by measuring the amount of error, and insuring greater accuracy than by any of the old methods of truing work.

Saves its cost in a week.

Twelve uses for the Bath Indicator.

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4. Setting taper attachment.
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6. Setting compound rest in turning bevel gears.
7. Truing spindle to long arbor.
8. Testing hole of spindle.
9. Taking eccentricity of shaft when straightening.
10. Setting work true in chuck.
11. Matching angle irons on planer.
12. Setting cross-bar of planer to platen and testing platen.

Send for complete descriptive catalogue to

The Bath Indicator Co., - - Hyde Park, Mass.

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F. B. PRATT, Secretary.

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Three Ways

of driving a shaft at right angles.

1. Muley Belt--an unmitigated nuisance.
2. Bevel Gears--better, but noisy.
3. Almond Countershaft--best, less friction and no noise.

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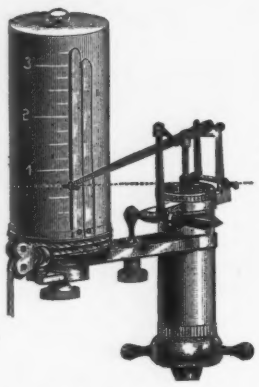
No Good Indicator



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We have a good variety to select from and every instrument is sent out guaranteed perfect.

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PLANIMETERS,
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Do You attach importance to the ECONOMY that reaches down into the small items? Each one of these devices are right in the line of ECOMONY in the operation of a steam plant and to those who may be interested, we will gladly send a catalogue and quote low prices.

SQUARE FLAX PACKING, HINE'S ELIMINATOR,
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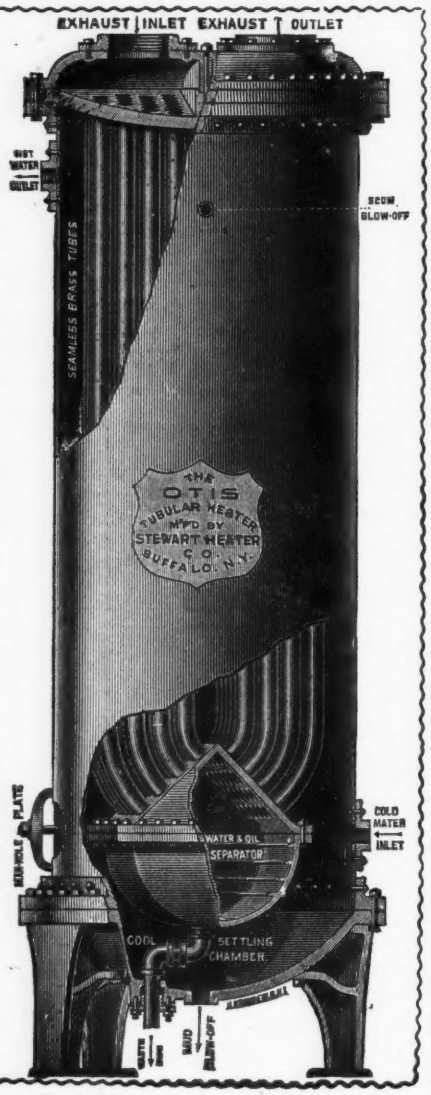
The "Otis" Tubular
Feed-Water HEATER, and Purifier,
With Seamless Brass Tubes.



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Our Standard Heaters have one square foot of heating surface per horse-power.

It will heat the feed water 210 or 212 degrees (the boiling point) with the exhaust steam, without causing any back pressure.

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☞ We guarantee our Heaters to do all we claim for them, and they are sold on their merits. : : If Heaters are not as represented, and fail to do what we claim for them, there will be no cost to parties trying them, for WE WILL PAY FREIGHT. CARTAGE AND ALL PIPING.

Send for Catalogue and reduced prices to . .

The Stewart Heater Co.,
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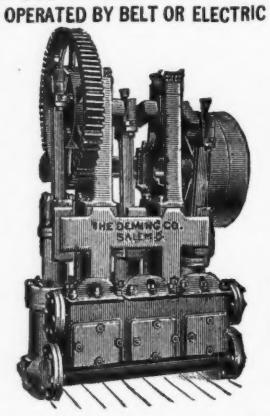
Triplex Pumps
FOR EVERY DUTY.
CAN BE OPERATED BY BELT OR ELECTRIC MOTOR.

For Boiler Feeding, Hydraulic Elevators, etc.



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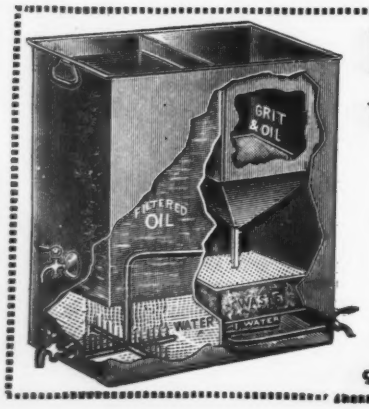

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The irons retain the heat longer.
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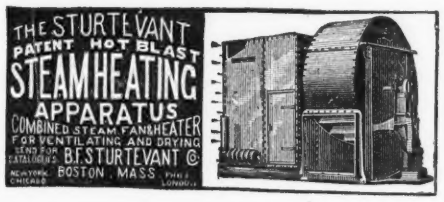

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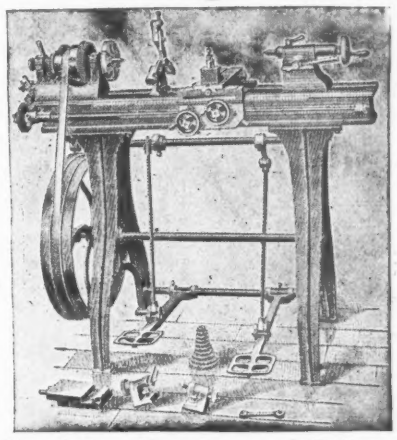

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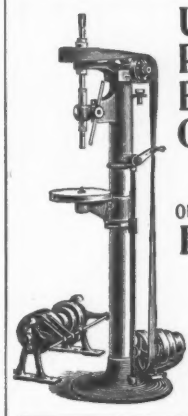

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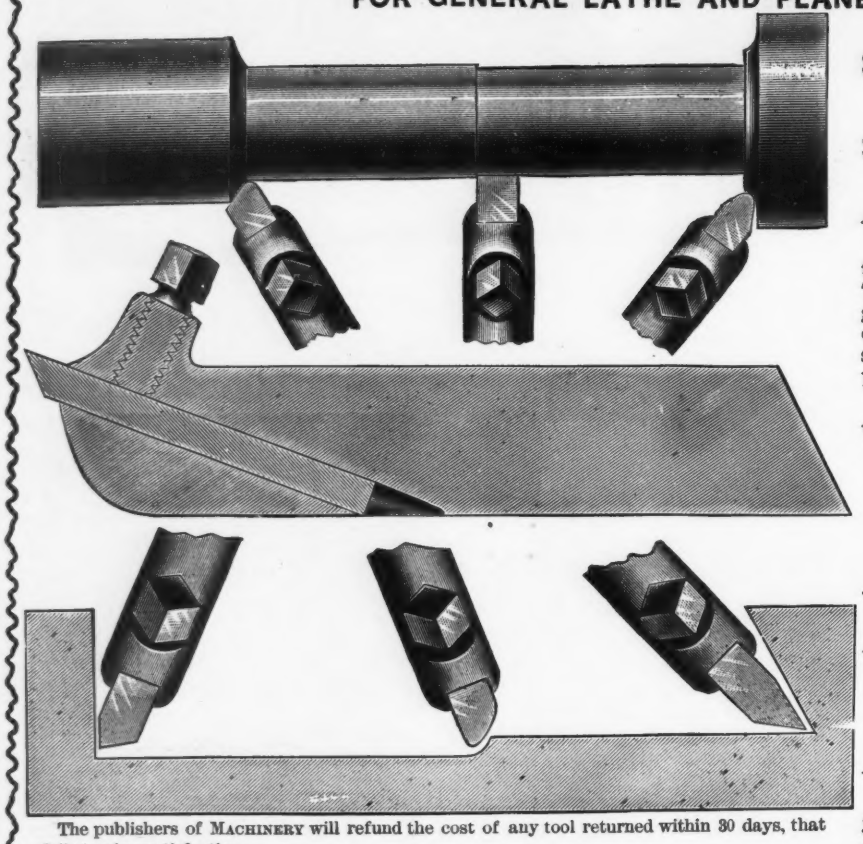

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1	1/2 x 1 x 6 "	1/4 " "	1.80	20c.	15 " "
2	5/8 x 1 1/4 x 7 "	5/16 " "	2.30	35c.	22 " "
3	3/4 x 1 5/8 x 8 "	3/8 " "	3.00	55c.	30 " "
4	7/8 x 1 1/2 x 9 "	7/16 " "	3.80	Exp.	40 " "
5	1 x 1 5/8 x 10 "	1/2 " "	4.75	"	50 " "
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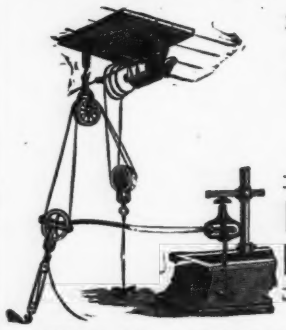

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Stevens' Fine Machinists' Tools.

PRICE 50 CENTS.

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We also make a great variety of special Chucks for holding bicycle parts, valves, fittings and other special shaped pieces. A 44-page catalogue sent on application.

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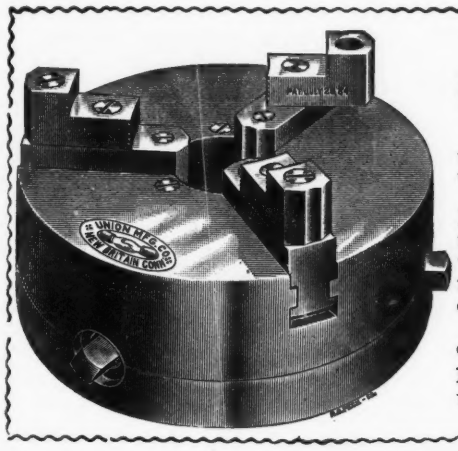

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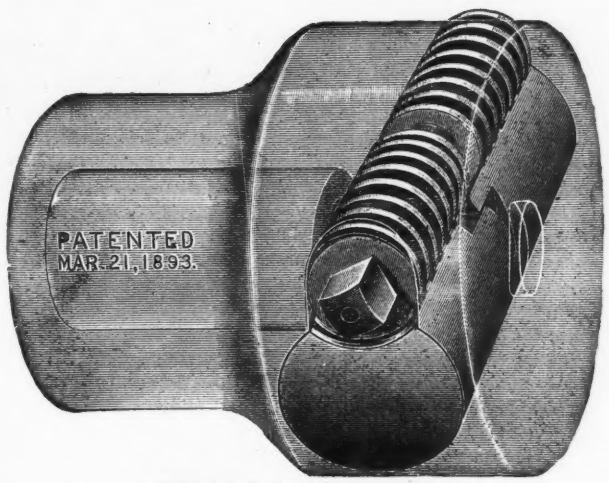

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WE MAKE THE

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STYLE B,

IN 4 SIZES, AS FOLLOWS, VIZ.

Approximate Diam.	Will Hold Drill—	List Price.
13/16 inch.	0 to 1/4 in.	$7.00
25/8 "	0 " 1/2 "	8.00
2 11/16 "	0 " 3/4 "	9.00
3 1/16 "	0 " 1 "	10.00

The E. Horton & Son Company,
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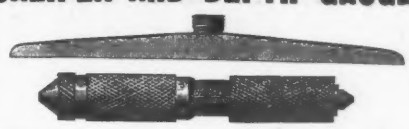

This tool as an inside caliper is of great value in measuring allowances in making fits and other work. It has a range (with the 4 wires furnished) from 2¼ to 9 inches. Longer wires are easily cut from 5-32 wire. The micrometer screw has a range of ¼ inch and reads to thousandths. As a depth guage it will measure standard lengths from zero to the length of graduated wire. It is warranted well-made and accurate.

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MANUFACTURERS OF
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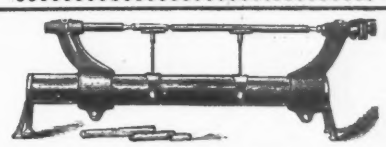
EVERY TOOL WARRANTED.
Catalogue Free.



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Measuring Machines.

Measuring screw, 10, 16 or 20 threads to the inch, graduated to read thousands or 32ds without calculation.

The only Micrometer that will not lose its accuracy by wear.

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WORCESTER, MASS.
DROP FORGINGS
— WOOD WORKERS' VISES —

Scroll Saws

"Fleetwood" and "Dexter,"

High Grade,

Low Price.

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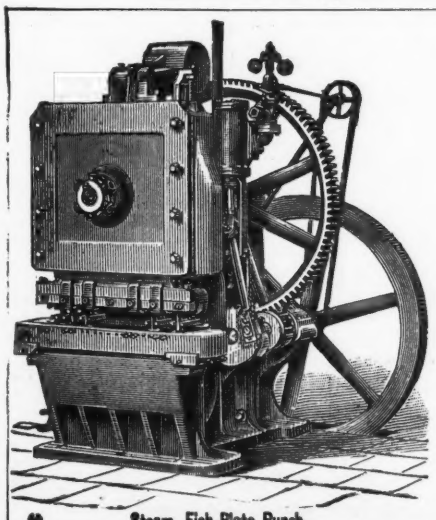

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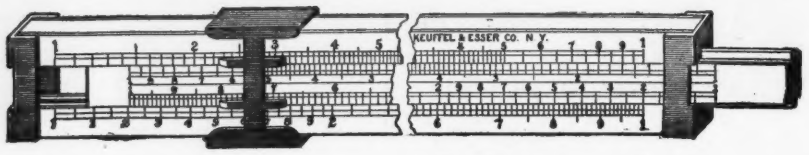

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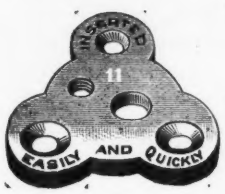

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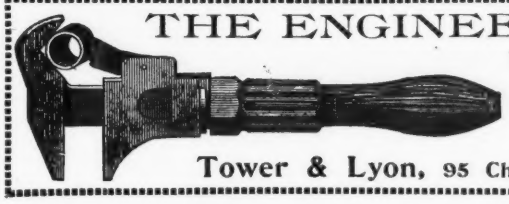

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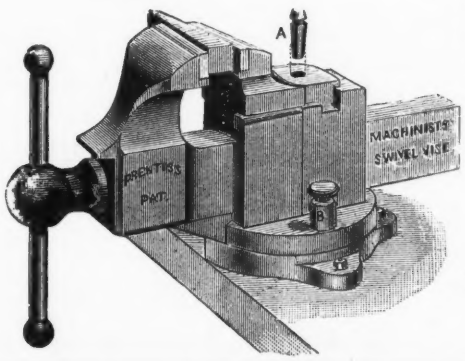

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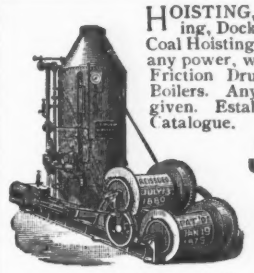

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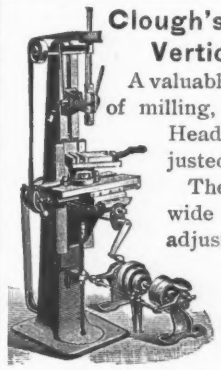

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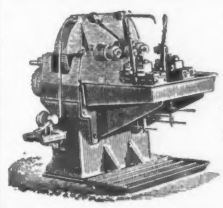

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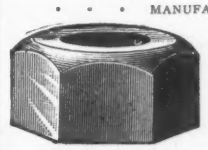

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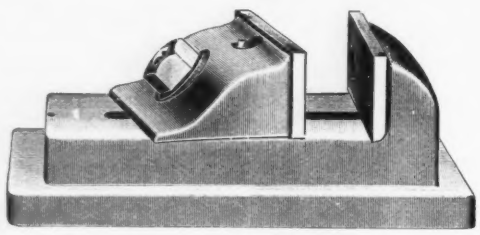

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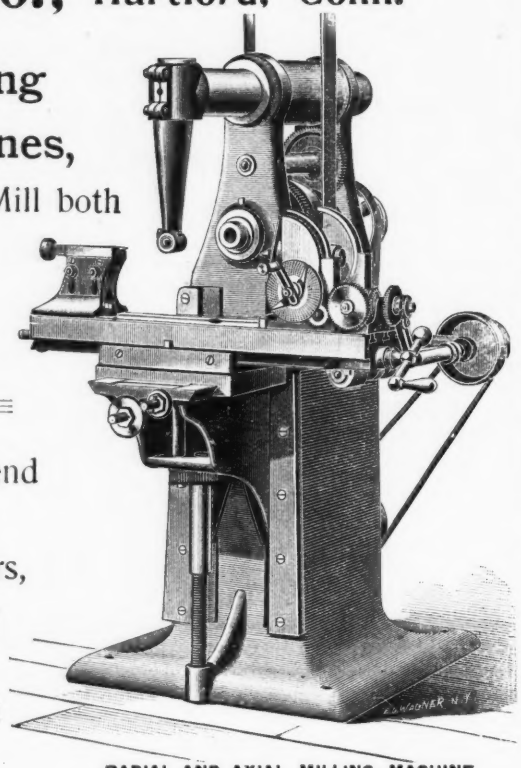

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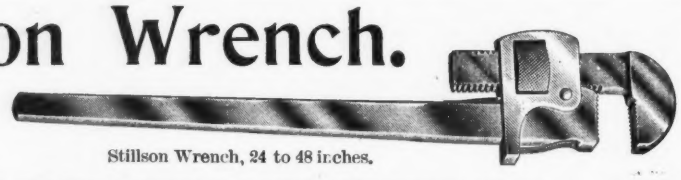

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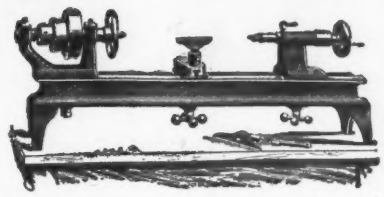

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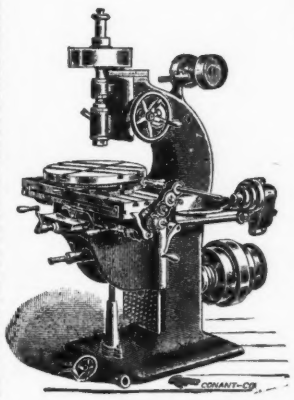

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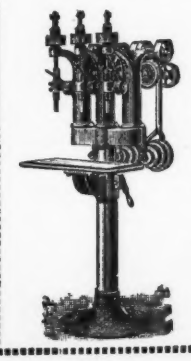

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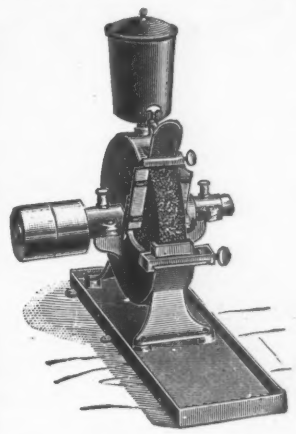

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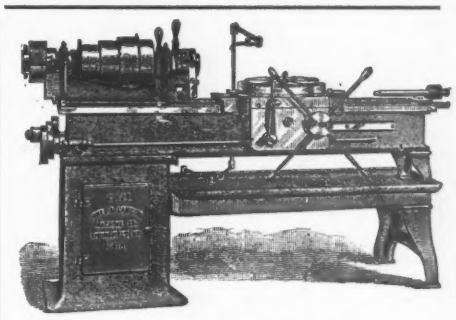

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And other Turret Machinery.
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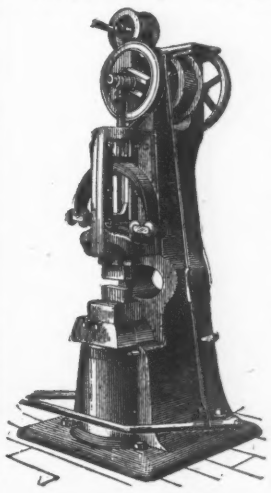

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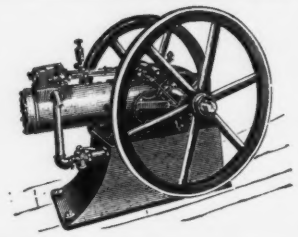

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Surface Grinders

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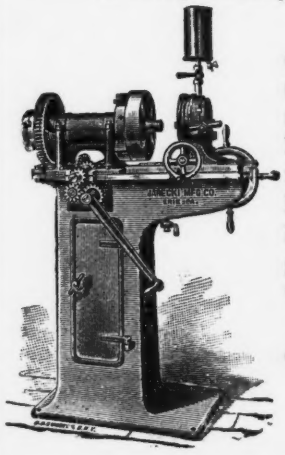

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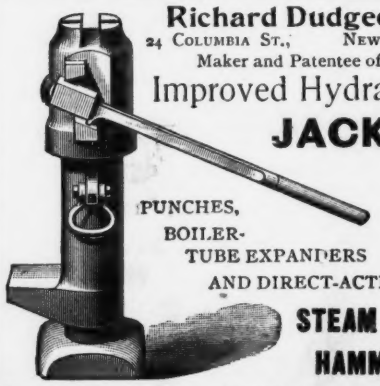

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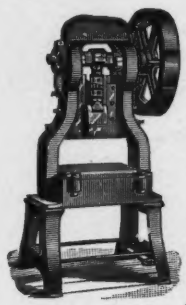

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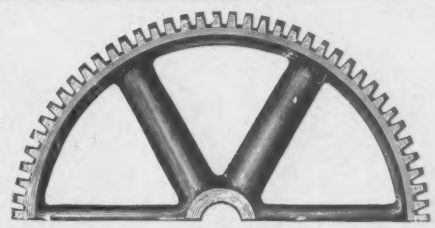

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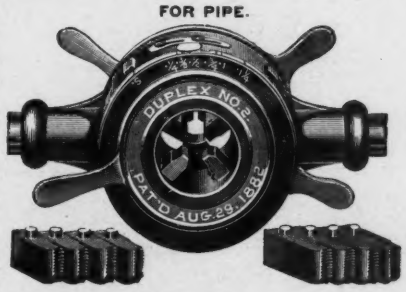

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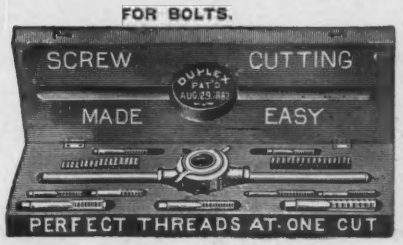

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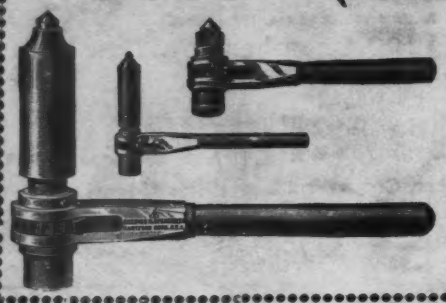

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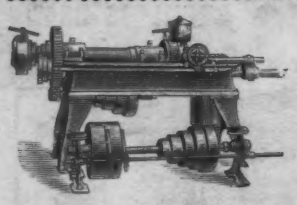

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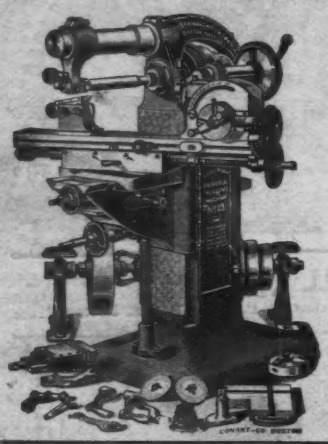

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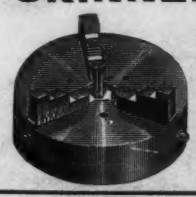

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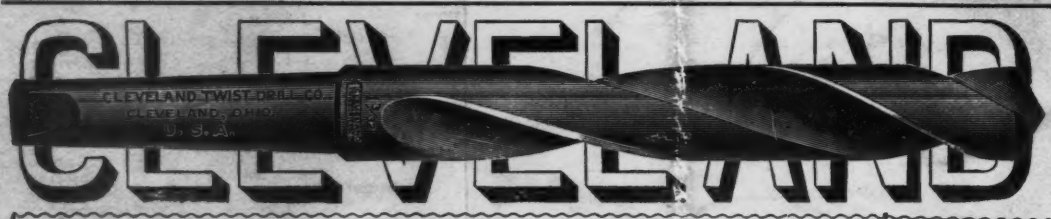

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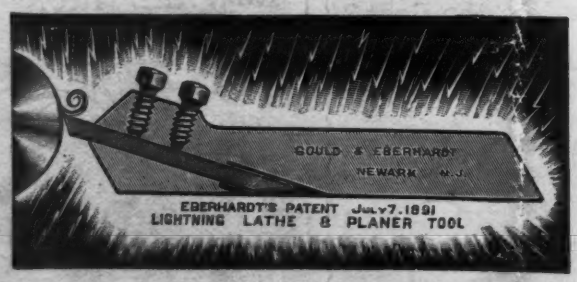

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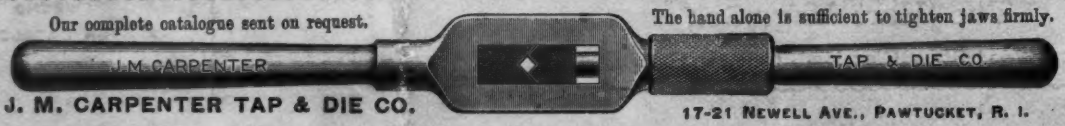

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